

A revision of the Japanese species of the family Bucculatricidae (Lepidoptera)Shigeki KOBAYASHI¹⁾, Toshiya HIROWATARI¹⁾ and Hiroshi KUROKO²⁾¹⁾ Entomological laboratory, Graduate School of life & Environmental Sciences, Osaka Prefecture University, Sakai, Osaka, 599-8531 Japan²⁾ 1-4-3, Mai, Hannan, Osaka, 599-0224 Japan

Abstract The Japanese species of the family Bucculatricidae are taxonomically revised and the life histories of each species are investigated. In Japan, in the past only three species, *Bucculatrix firmanella* Kuroko, 1982, *B. pyrivorella* Kuroko, 1964, and *B. citima* Seksjaeva, 1989, had been recorded. We recently described *B. hamaboella* Kobayashi, Hirowatari & Kuroko, 2009 (Kobayashi *et al.*, 2009) and recorded *B. comporabile* Seksjaeva, 1989 and *B. demaryella* (Duponchel, 1840) from Japan (Arita *et al.*, 2009). In this study, a total of 23 species of the genus *Bucculatrix* Zeller were recorded from 18 different plant species belonging to 10 plant families. Four new species, *B. muraseae* sp. nov. (Host: *Alnus japonica*, Betulaceae), *B. serratella* sp. nov. (Host: *Zelkova serrata*, Ulmaceae), *B. kogii* sp. nov. (Host: Unknown), and *B. tsurubamella* sp. nov. (Host: *Quercus acutissima*, Fagaceae) are described. Eleven species, *B. splendida* Seksjaeva, 1992, *B. laciniatella* Benander, 1931, *B. maritima* Stainton, 1851, *B. notella* Seksjaeva, 1996, *B. nota* Seksjaeva, 1989, *B. sinevi* Seksjaeva, 1988, *B. altera* Seksjaeva, 1989, *B. armata* Seksjaeva, 1989, *B. univoca* Meyrick, 1918, *B. thoracella* (Thunberg, 1794), and *B. cidarella* (Zeller, 1839) are newly recorded from Japan. *Bucculatrix* sp. 1–4 recorded by Oku (2003) from Iwate Prefecture were also examined.

In the course of this study, fifteen species were reared, and the biology of seven species is described for the first time.

Sixteen of the Japanese species are grouped into three main types on the basis of larval habits for the first time. The 23 Japanese species are separated into 10 groups based on genital structures, mainly following the species groupings of Braun (1963) and Baryshnikova (2008).

Female adults were examined from 18 species in Japan (excluding *B. laciniatella*, *B. nota*, and *B. kogii*). In all examined species, we found that the ductus seminalis is attached to the middle of the corpus bursae, here proposed as an autapomorphy of the genus *Bucculatrix*.

Key words Bucculatricidae, *Bucculatrix*, taxonomy, host plant, Japan.

Introduction

The Bucculatricidae is one of the smallest leaf-mining microlepidopteran families. Approximately 250 species are known globally; nearly 30 plant families have been reported as hosts (Davis & Robinson, 1998), with the Asteraceae, Betulaceae and Fagaceae being particularly favored (Braun, 1963; Seksjaeva, 1994). This family is characteristic in having an elongate pointed face, roughly tufted head, and antennae with a basal eye-cap (Braun, 1963; Kuroko, 1964; Kuroko, 1982). Leaf-mining Lepidoptera are among the poorest known groups of Lepidoptera, because of their typically small size and rich diversity (Davis *et al.* 2002). The larvae of *Bucculatrix* are leaf miners in the 1st and 2nd instars, forming short, very narrow, tortuous or spiral mines. At the end of the 2nd instars, the larvae quit the mine, and spin a cocoon-shaped web (“cocoonet”: Stainton, 1862; “moulting cocoon”: Braun, 1963) on the surface of the leaf. The 3rd and 4th instars feed externally on the surface of the leaf, skeletonizing it (Braun, 1963; Kuroko, 1964). The larvae spin an elongate, longitudinally ribbed cocoon on the leaf or branch (Kuroko, 1964; Kuroko, 1982).

In North America, Braun (1963) revised the Bucculatricidae and reported 99 species. She

grouped them into eight sections: these sections are based primarily on the genitalic structure, which is however often correlated with food plant groups. Some North American species have larvae which produce galls on their food plants and feed within them, or if miners in the earlier instars, become stem borers in the later instars. Members of the Asteraceae are probably hosts to nearly two thirds of the species.

The Palaearctic species have earlier been systematized on the basis of the comparative morphological analysis of the male genitalia, with the establishment of 11 infra-generic groups (Seksjaeva, 1994; 1998). Recently, the genus *Bucculatrix* has been revised, and the relationships among 16 groups of the Holarctic species have been examined using a phylogenetic analysis (Baryshnikova, 2002; 2008). In Russia, at least 50 species were known, especially in the Southern Maritime Territory, and approximately 20 new species had previously been described (Kuznetsov *et al.*, 1988; Seksjaeva, 1989a; 1992; 1996; Baryshnikova, 2005).

In contrast in Japan, only three species were known: *Bucculatrix firmianella* Kuroko, 1982 (host plant: *Firmiana simplex*, Sterculiaceae), *B. pyrivorella* Kuroko, 1964 (host plant: *Pyrus pyrifolia*, *Malus pumila* var. *domestica*, *Prunus* × *yedoensis*, Rosaceae), and *B. citima* Seksjaeva, 1989 (host plant: *Rhamnus davurica* Pall. var. *nipponica*, Rhamnaceae), which was recently recorded in Iwate Prefecture by Oku (2003). Owada *et al.*, (2006) recorded an unidentified species of *Bucculatrix* from the garden of the Imperial Palace, Tokyo (Japanese name: “Keyaki-Chibiga”), which is a leaf miner of *Zelkova serrata*, Ulmaceae. Some unnamed species have been also collected from several plants, such as *Artemisia*, Asteraceae (Murase, 2003; Oku, 2003). Recently, *B. hamaboella* Kobayashi, Hirowatari & Kuroko, 2009 was described from Wakayama Prefecture (Kobayashi *et al.* 2009) and *B. comporabile* Seksjaeva 1989 and *B. demaryella* (Duponchel, 1840) were recorded from Tochigi Prefecture (Arita *et al.*, 2009). In addition, unpublished data by Kuroko & Murase (pers. comm.) show there are at least five unrecorded species, including new species in Honshu and Kyushu. Kogi (pers. comm.) also preserved specimens of at least six previously unrecorded species from five unrecorded host-plants in Hokkaido.

In this paper, Japanese species of the family Bucculatricidae are taxonomically revised and the life histories of each species are investigated based on the above-mentioned materials. An autapomorphy of the genus *Bucculatrix* based on the female genitalia is proposed.

Material and methods

Specimens were collected from March to December in 2007–2008 and March to June in 2009 in following prefectures; Hokkaido (Obihiro, Ishikari), Nagano (Matsumoto), Aichi (Shidara), Mie (Nabari, Matsusaka), Nara (Soni), Osaka (Osaka Pref. Univ., Kumatori, Mt. Mikusa, Mt. Izumi-Katuragi), Wakayama (Wakayama, Gobo, Shionomisaki), Hyogo (Inagawa) and Okinawa (Ishigaki Is.). Adult specimens preserved in the Entomological Laboratory, Osaka Prefecture University (OPU), and those collected by N. Hirano (Matsumoto), H. Kogi (Sapporo), M. Murase (Wakayama) were examined. *Bucculatrix* sp. 1–4 recorded by Oku (2003) from Iwate Prefecture were also examined. Collected larvae and cocoons from leaf, branch, and trunk of host plants, and were reared in plastic cups (420 ml: 129 π × 60 H) with wet cotton in the laboratory under near natural conditions. Leaf mine, each instar larva, cocoonet and cocoon were observed.

For preparation of the male and female genitalia, the abdomen was removed and boiled for 3–4 minutes in 10% aqueous KOH. The genitalia were stained with acetocarmine. All the examined specimens are presently deposited in OPU.

The terminology follows Kuroko (1964, 1982), Seksjaeva (1989a), Davis & Robinson

(1998), and Baryshnikova (2005).

Taxonomy

Genus *Bucculatrix* Zeller

Bucculatrix Zeller 1839. *Isis*, **1839**: 214. Type species: *Lyonetia albedinella* Zeller 1839. (= *boyerella* Duponchel). Stainton, 1854, *Ins. Brit. Lep.*: 290; Meyrick, 1893, *Proc. Linn. Soc. N. S. Wales*. **7**: 600; id., 1895, *Hand. Brit. Lep.*: 729; Spuler, 1910, *Schmett. Eur.*, **2**: 418; Forbes, 1923, *Cornell Univ. Agr. Exp. Sta. Mem.* **68**: 155; Meyrick, 1929, *Rev. Hand. Brit. Lep.*: 813; Pierce & Metcalfe, 1935, *Genitalia Tin. Fam. Lep. Brit. Is.*: 91; Kuroko, 1964: 9; Braun, 1963: 4–6; Seksjaeva, 1989a: 182; Davis & Robinson, 1998: 112. Baryshnikova, 2008: 109–110.

Ceroclastis Zeller 1848. *Linn. Ent.*, **3**: 295, t. 2, fig. 47. Type species: *Lyonetia nigricomella* Zeller, 1839.

The following description of the genus is based on Braun (1963), Kuroko (1964), Seksjaeva (1989a), Davis & Robinson (1998), and Mey (2004). A new character of the female genitalia (*i.e.* attachment point of ductus seminalis) is added in this paper.

Description. Face smooth; head roughly tufted with long hair-scales (Fig. 2). Antennae 2/3 length of forewing, forming an eye cap; 1st segment of flagellum slightly elongate, and in male with a deep notch.

Forewings lanceolate and shortly caudate; Color of forewings white to chocolate brown, neither lustrous nor metallic. Pattern of forewings consisting of patches and oblique streaks arranged along costal and posterior margins. Hindwings 2/3 of forewing; narrow-lanceolate.

Posterior tibiae with long hairs above and below. Abdomen unspined; an eversible sac with a flower-like patch of specialized scales present as a mid-dorsal invagination of membrane between 2nd and 3rd abdominal segments.

Male genitalia. Uncus absent. Socii developed to form 2 setose lobes. Valvae tapered or rounded, basal angles of costae usually produced as free arms; saccus sometimes semicircular. Aedeagus rather elongate, more or less cylindrical.

Female genitalia. Ovipositor short, modified for rasping or piercing in some species. Apophyses anteriores sometimes distinct. Genital plate often densely set with scales; corpus bursae with a signum consisting of spined ribs. Ductus seminalis very long and slender; point of attachment at the middle of corpus busae.

Biology. The larvae when very young (1st and 2nd instars, sometimes 3rd instars) are monophagous or oligophagous leaf miners, forming short, very narrow, tortuous or spiral mines. At the end of the 2nd instars, the larvae quit the mine, and spin on the surface of the leaf the “cocoonet”, usually a thin smooth sheet of silk within which the larva remains motionless in a U-shape for a considerable time and molts. A second cocoonet, similar to the first but slightly larger, is spun at the end of the 3rd instar. In the 3rd and 4th instars (sometimes 5th instars), the larvae feed exposed on the surface of the leaf. They nibble the epidermis and some mesophyll on the upper surface of the leaf, skeletonizing it or sometimes grazing leaf tissue through circular holes. Pupation takes place in an elongate ribbed cocoon on the surface of a leaf or branch. The surroundings of the cocoon are enclosed with about 30 or more vertical silken threads which are arranged elliptically. In North America, the larvae of some species are known to be gall-makers and stem borers. The cycle of development is short, allowing two, or even three generations in a season. The winter is passed in the pupal state in the majority of species. Some few species may hibernate in the imaginal stage. The spectrum of food plants is very wide and includes herbs (*e.g.* Asteraceae), shrubs (*e.g.* Rhamnaceae, Malvaceae), and trees (*e.g.* Rosaceae, Sterculiaceae, Betulaceae,

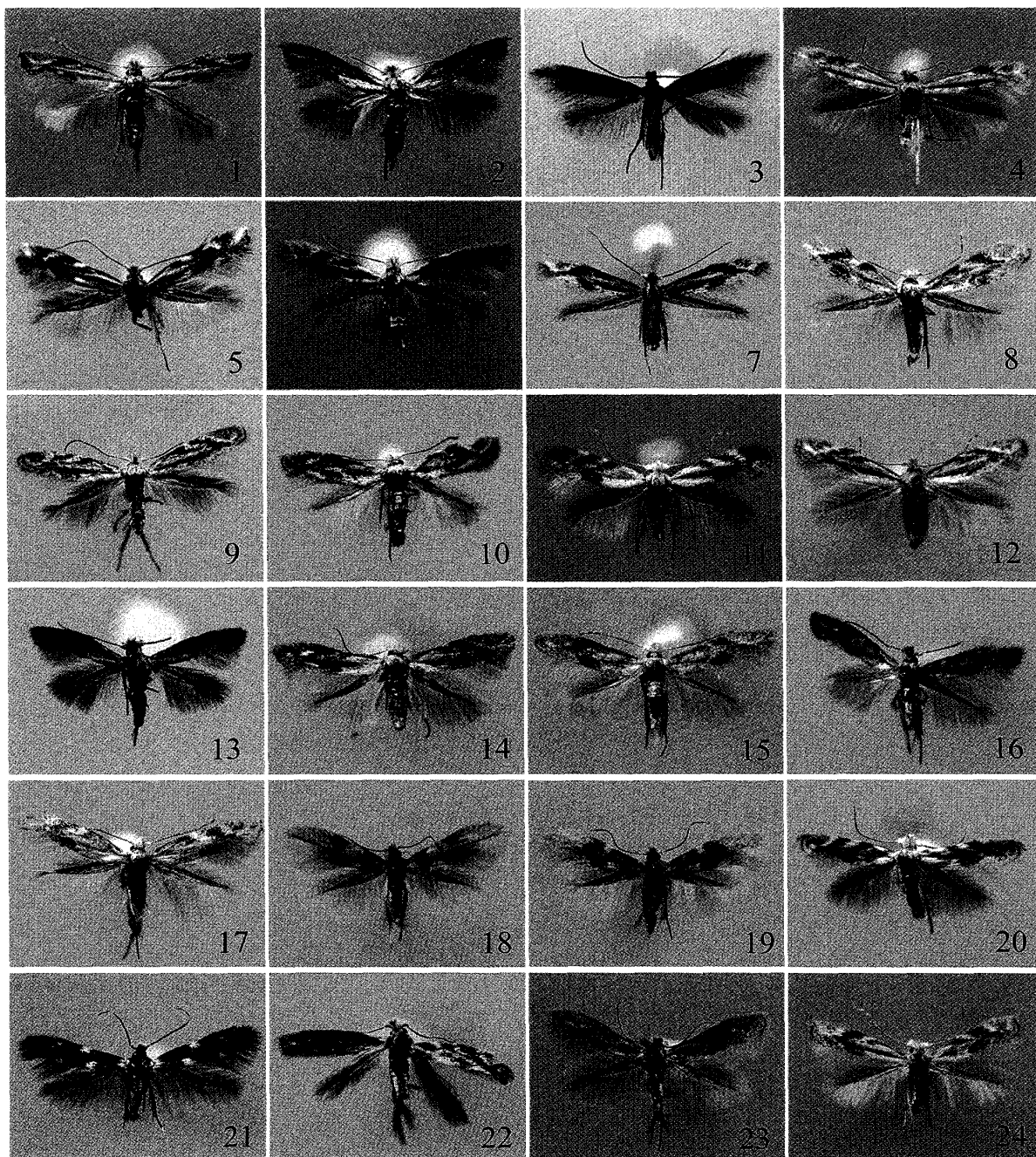


Plate 1. Adults of *Bucculatrix* species from Japan. 1. *B. firmianella* ♂. 2. *B. hamaboella*, Holotype ♀. 3. *B. splendida* ♀. 4. *B. laciniatella* ♂. 5. *B. maritima* ♂. 6. *B. notella* ♀. 7. *B. nota* ♂. 8. *B. sinevi* ♂. 9. *B. altera* ♀. 10. *B. pyrivorella* ♀. 11. *B. citima* ♀. 12. *B. armata* ♂. 13. *B. univoca* ♂. 14. *B. demaryella* ♀, hostplant: *Castanea crenata* (Nagawa, Nagano Pref.). 15. *Ditto*, ♂, hostplant: *Betula platyphylla* var. *japonica*. (Tokachi-mitsumata, Hokkaido). 16. *B. serratella* sp. nov., Holotype ♂. 17. *B. kogii* sp. nov., Holotype ♂. 18. *B. thoracella* ♂ (Odaigahara, Nara Pref.). 19. *Ditto* ♀ (Ishikari, Hokkaido). 20. *B. muraseae* sp. nov., Holotype ♂. 21. *B. cidarella* ♂. 22. *B. tsurubamella* sp. nov., Holotype ♂. 23. *B. comporabile* ♂ cocoon on *Quercus serrata* (Mt. Mikusa, Osaka Pref.). 24. *Ditto* ♂ hostplant: *Q. crispula* (Ishikari, Hokkaido)..

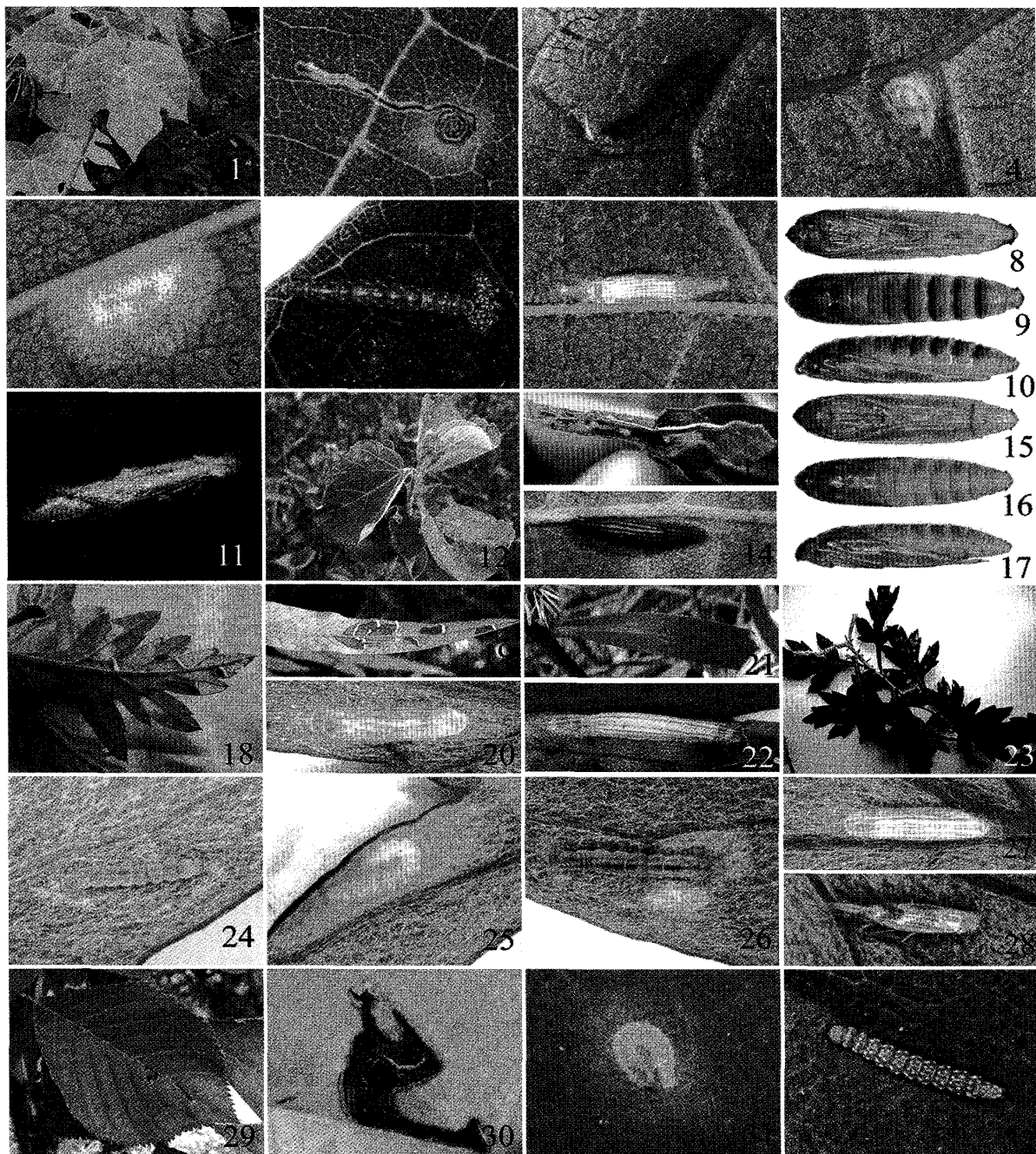


Plate 2. Immature stages of *Bucculatrix* spp. and the hostplants. 1–11. *B. firmianella* and *Firmiana simplex*. 12–17. *B. hamaboella* and *Hibiscus hamabo*. 18–20. *B. splendida* and *Artemisia princeps*. 21–22. *B. maritima* and *Aster tripolium*. 23–28. *B. notella* and *A. princeps*. 29–32. *B. pyrivorella* and *Prunus* × *yedoensis*. 1, 12, 18, 21, 23, 29: Hostplant, leaf and mine. 2, 30: Spiral linear mine by young larva. 3, 31: 2nd instar larva within 1st cocoonet. 4, 32: 3rd instar larva. 5: 3rd instar larva within 2nd cocoonet. 6: 4th instar larva. 7, 14, 20, 25: Cocoon. 8, 15: Pupa (ventral view). 9, 16: *Ditto* (dorsal view). 10, 17: *Ditto* (lateral view). 11, 28: Resting posture of the adult. 13. Later instar larva, boring into young stem. 19. Feeding damage and final instar larva.

Fagaceae).

In this study, sixteen species were reared (except for *B. nota* Seksjaeva, 1992), and the biology of eight species is described in this paper for the first time. The species have several generations in a year, 1–2 in Hokkaido, 2–3 in West Japan (mainly the Kinki region and Mie Pref.). The exact number of larval instars was not detectable except for *B. firminaella* and *B. pyrivorella*.

Distribution. Cosmopolitan.

Key to the species of Bucculatrix based on Coloration and Markings of Forewing

1. Forewing not white 2
 - Forewing white, creamy white, ochereous-white or pale with dark to ochereous or pale, light, brown streaks or patches 5
2. Forewing black 3
 - Forewing brown (*e. g.* light orange brown and blackish brown) 4
3. Forewing black, without any irrorations; vertex tuft black *splendida* Seksjaeva
 - Forewing black with some triangular white spots along costa and dorsum; vertex tuft orange *cidarella* (Zeller)
4. Forewing light orange brown with dark marks or patches at 1/2; vertex tuft light orange brown *thoracella* (Thunberg)
 - Forewing blackish brown with some black plical dots; vertex tuft blackish brown *univoca* Meyrick
5. Forewing with oblique streaks 6
 - Forewing with obscure streaks or patches 11
6. Forewing with 2 clear oblique streaks; one from costa at 1/2 to dorsum, another from costa at 1/3 to termen 7
 - Forewing without 2 clear oblique streaks 8
7. Oblique streaks light brown, basal streak, light brown at 1/3 *muraseae* sp. nov.
 - Oblique streaks dark red brown. Basal streak lacking, white spot from base to 1/3. *citima* Seksjaeva
8. Basal streak white and distinct; Forewing chocolate brown *maritima* Stainton
 - Basal streak brown to yellow and indistinct 9
9. Forewing white with light brown. vertex tuft light brown *laciniatella* Benander
 - Forewing creamy white with chocolate brown to darker or paler oblique streaks. Vertex tuft white, with a chocolate or light brown cluster of scales in center 10
10. Oblique streaks on costa at 1/3 distinct *notella* Seksjaeva
 - Oblique streaks on costa at 1/3 indistinct *nota* Seksjaeva
11. Clear black patches or scales; one on costa at 1/2, two on dorsum at 1/2 12
 - Without black patches 13
12. Black patches on costa at 1/3 *sinevi* Seksjaeva
 - Brown spot or scales on costa at 1/3 *demaryella* (Duponchel)
13. Forewing with obscure ochereous brown patches 14
 - Forewing without obscure ochereous brown patches 16
14. Forewing ochereous white with brownish-ochereous patches *serratella* sp. nov.
 - Forewing creamy white or white 15
15. Forewing with obscure orange brown patches. Vertex tuft with light orange cluster of scales in center *tsurubamella* sp. nov.
 - Forewing with obscure brown patches. Vertex tuft with brown cluster of scales in center *comporabile* Seksjaeva

16. Forewing with ochereous or brown orange patches 17
 - Forewing with ochereous~brown to dark brown patches 18
17. Forewing ochereous orange; apical cilia with a fuscous median line .. *pyrivorella* Kuroko
 - Forewing orange brown; a fuscous median line indistinct *armata* Seksjaeva
18. Vertex tuft creamy white, mixed with ochereous scales centrally *kogii* sp. nov.
 - Vertex tuft creamy white, mixed with brown to dark brown scales centrally 19
19. Forewing ochereous white with very obscure yellowish-brown patches. Vertex tuft slightly sprinkled with brown scales centrally *firmianella* Kuroko
 - Forewing creamy white with chocolate to dark brown patches or streaks 20
20. Dark brown patches or streaks, black plical dot on dorsum at half *hamaboella* Kobayashi, Hirowatari & Kuroko
 - Chocolate brown to brown patches or streaks, black plical dot indistinct *altera* Seksjaeva

Key to the Species of Bucculatrix Based on Male Genitalia

1. Socii absent or weakly present, modified indistinctly with very small lobes 2
 - Socii present, modified with definite 2 lobes 6
2. Vinculum triangular or trapezoid 3
 - Vinculum narrowed and ringed, valva arm-shaped terminating in heavy setae at apex, Aedeagus with minute cornuti in groups in vesica *citima* Seksjaeva
3. Length of aedeagus nearly equal to length of valva *sinevi* Seksjaeva
 - Length of aedeagus more than 2.0 times length of valva 4
4. Aedeagus without cornuti in vesica *pyrivorella* Kuroko
 - Aedeagus with some cornuti in vesica 5
5. Aedeagus with many long series of spiny cornuti in vesica *altera* Seksjaeva
 - Aedeagus with one large acute cornutus at middle of vesica *armata* Seksjaeva
6. Valva with an inward hooked process, terminating in heavy setae *univoca* Meyrick
 - Valva without an inward hooked process 7
7. Tegumen not developed 8
 - Tegumen + uncus broad 10
8. Length and width of socii almost equal to that of valva 9
 - Width of socii less than width of valva 16
9. Length of aedeagus about 3 times length of valva *firmianella* Kuroko
 - Length of aedeagus less than 2.0 times length of valva; valva with a blunt conical seta at apex *hamaboella* Kobayashi, Hirowatari & Kuroko
10. Socii on ventral sides of tegumen 11
 - Socii concave lobes at apex of tegumen 13
11. Socii small and indistinct *notella* Seksjaeva
 - Socii distinct 12
12. Socii cylindrical in form, oblong *nota* Seksjaeva
 - Socii basally rounded with a digitate lobe sp. 2 (nr. *varia* Seksjaeva)
13. Valva with deep notch at apex *maritima* Stainton
 - Valva tapering to apex or rounded at apex 14
14. Length of aedeagus more than 2.0 times length of valva; aedeagus strongly curved at apex *laciniatella* Benanber
 - Length of aedeagus more than 3.0 times length of valva 15
15. Aedeagus not rolled at apex *splendida* Seksjaeva
 - Aedeagus strongly rolled 1/6 from apex sp. 1 (nr. *bicinica* Seksjaeva)
16. Length of vinculum almost equal to length of valva 17

- Length of vinculum less than length of valva..... 18
- 17. Valva broad and weakly divided into 2 lobes near apex; aedeagus with a few minute cornuti..... *demaryella* (Duponchel)
- Valva rounded at apex, median slender; aedeagus tapering to acute apex *serratella* sp. nov.
- 18. Aedeagus with vesica broadened with numerous short heavy cornuti..... *kogii* sp. nov.
- Aedeagus without cornuti..... 19
- 19. Valva very short and rounded 20
- Valva long and slender..... 21
- 20. Valva unfused with vinculum and rounded at apex *comporabile* Seksjaeva
- Valva fused with vinculum and pointed at apex..... *tsurubamella* sp. nov.
- 21. Juxta very short; aedeagus not acute at apex *thoracella* (Thunberg)
- Juxta equal to half the length of the aedeagus; tapering to apex 22
- 22. Socii oblong and slender lobes *muraseae* sp. nov.
- Socii oval, concave lobes *cidarella* (Zeller)

Key to the Species of Bucculatrix Based on Female Genitalia

- 1. Lamella antevaginalis with two horn-shaped processes..... 2
- Lamella antevaginalis without horn-shaped processes..... 3
- 2. Antrum telescope-like; ductus bursae very wide, curved and longitudinally folded *altera* Seksjaeva
- Antrum membranous; ductus bursae slender *sinevi* Seksjaeva
- 3. Lamella antevaginalis developed..... 4
- Lamella antevaginalis undeveloped..... 5
- 4. Lamella antevaginalis fan shaped, with a dent in the centre at apex; antrum cylindrical, joint-like over half length of antrum *demaryella* (Duponchel)
- Lamella antevaginalis with a slender lobe and numerous short lobes located at both sides of ostium bursae; antrum weakly sclerotized..... *thoracella* (Thunberg)
- 5. On each side at margin of segment 8 a group of specialized scales 6
- On each side at margin of segment 8 without specialized scales 8
- 6. Length of apophysis anterioris more than 3 times length of apophysis posterioris *splendida* Seksjaeva
- Length of apophysis anterioris almost equal to half length of apophysis posterioris 7
- 7. Ostium bursae cup-shaped; antrum bent to the right..... *notella* Seksjaeva
- Ostium bursae slender; antrum tubular..... *hamaboella* Kobayashi, Hirowatari & Kuroko
- 8. Posterior margins of segment 7 fringed with long specialized scales dorsally 8
- Posterior margins of segment 7 not fringed with specialized scales 9
- 9. Long specialized scales present ventrally except round ostium bursae *comporabile* Seksjaeva
- without specialized scales round ostium; lamella antevaginalis short, spine-shaped *tsurubamella* sp. nov.
- 10. Antrum very broad, longitudinally folded..... 11
- Antrum slender and tubular or sclerotized and plate-like..... 12
- 11. Ostium bursae circled; ductus bursae long and sinuous..... *armata* Seksjaeva
- Ostium bursae widely; ductus bursae very short *citima* Seksjaeva
- 12. Ventral part of segment 8 strongly sclerotized, anterior part with wavy wrinkles, posterior part sulcate with longitudinally sinuate wrinkles and numerous small wrinkles..... *serratella* sp. nov.
- Ventral part of segment 8 weakly sclerotized..... 13

13. Ostium bursae bulging *pyrivorella* Kuroko
- Ostium bursae slender 14
14. Ostium bursae with a conical invagination; point of attachment of antrum at the middle of invagination of ostium bursae 15
- Ostium bursae without conical invagination; antrum flat and sclerotized 16
15. Antrum sclerotized and plate-like *muraseae* sp. nov.
- Antrum bursae membranous *cidarella* (Zeller)
16. Apophysis anterioris present; antrum flat and sclerotized and with lacinated lateral portions *univoca* Meyrick
- Apophysis anterioris absent; antrum slender, sclerotized and plate-like *firmianella* Kuroko

Key to the Species of Bucculatrix Based on Leaf Mines and Larval Habits²

1. Larvae forming serpentine leaf mines 2
- Larvae forming linear leaf mines 7
2. Young mine with convolutions 3
- Young mine coiled in an intestine-like fashion 6
3. Mine describing a smooth, clearly curving line 4
- Mine describing an angulate, not clearly curving line 5
4. Larvae mining leaves of *Firmiana simplex*; ~10–80 mines in a leaf (ca. ~10–15 mm in length) *firmianella* Kuroko
- Larvae mining leaves of buckthorn, *Rhamnus davurica* Pall. var. *nipponica*, and *R. japonica* var. *decipiens*; 1–2 mines in a leaf (ca. 15–30 mm in length) *citima* Seksjaeva
5. Larvae mining leaves of chestnut, *Castanea crenata*, Japanese white birch, *Betula platyphylla* var. *japonica*; 1–6 mines in a leaf (ca. 5–10 mm in length) *demaryella* (Duponchel)
- Larvae mining leaves of linden, *Tilia japonica*; ~10–30 mines in a leaf (ca. 10 mm in length) *thoracella* (Thunberg)
6. Larvae mining leaves of Japanese morning glory, *Ipomoea congesta*, and sweet potato, *I. batatas*; 1–4 mines in a leaf (ca. 30–60 mm in length) *univoca* Meyrick
- Larvae mining leaves of kinds of Japanese cherry, *Prunus* × *yedoensis*, apple, *Pyrus pyrifolia*, and pear, *Malus pumila* var. *domestica*; 1–3 mines in a leaf (ca. 20–30 mm in length), old mined portion turning brownish *pyrivorella* Kuroko
7. Larvae forming a long red linear mine toward the base of midrib; larvae mining leaves of *Hibicus hamabo*; 1–3 mines in a leaf (ca. ~30–60 mm in length), later instar larva becoming a stem borer *hamaboella* Kobayashi, Hirowatari & Kuroko
- Larvae forming a short linear mine; later instar larva becoming external feeder 8
8. Larvae mining leaves of *Artemisia princeps*; 1 mine in a leaf (ca. ~15–40 mm in length) 9
- Larvae mining leaves of various woody plants 10
9. Mine ; ~15–20 mm in length, later instar larva entering the leaf through circular holes and mining out the leaf tissue *notella* Seksjaeva³
- Mine; ~30–40 mm in length, later instar larva peeling away and rolling up the lower epidermis intact and eating irregular patches of the leaf tissue *splendida* Seksjaeva
10. Larvae mining leaves of Fagaceae species 11
- Larvae mine leaves of other families of woody plants 12
11. Larvae mining leaves of *Quercus acutissima*, usually along the midrib; 2–3 mines in a leaf (ca. 10–15 mm in length) *tsurubamella* sp. nov.

- Larvae mining leaves of *Quercus crispula*, *Q. dentata*, and presumably, *Q. serrata*; 1–3 mines in a leaf (ca. 10–20 mm in length)..... *comporabile* Seksjaeva
- 12. Larvae usually forming L-shaped mine; larvae mining leaves of *Zelkova serrata*, usually along the midrib; 1–3 mines in a leaf (ca. 10–13 mm in length)..... *serratella* sp. nov.
- Larvae usually forming J-shaped or free running mine 13
- 13. Larvae mining leaves of *Alnus japonica*; 1–3 mines in a leaf (ca. 20–26 mm in length)..... *muraseae* sp. nov.
- Larvae mining leaves of *Tilia japonica*; 10–30 mines in a leaf (ca. 10–20 mm in length)..... *armata* Seksjaeva

² This key, where only mines and/or cocoon and cocoonet have been examined, but not larvae or adults, can serve only as a partial aid to determination.

³ Larvae of *B. nota* mine leaves of *Artemisia princeps* (Oku, 2003), and their larval habits are similar to those of *B. notella*; but since we have not observed the larvae of *B. nota*, this key only serves for *B. notella*.

In this study, the 23 Japanese species are grouped into 10 groups based on genital structures, mostly following the species groupings of Braun (1963) and Baryshnikova (2008).

Group 1

Group 1 includes two species: *B. firmianella* Kuroko, 1982 (Host: *Firmiana simplex*, Sterculiaceae) and *B. hamaboella* Kobayashi, Hirowatari & Kuroko, 2009 whose larvae are stem borers feeding on *Hibiscus hamabo* (Malvaceae). This group is characterized by the long socii arising from lower portion on the tegumen, tending to diverge widely, the broad valva, narrow tegumen, and ringed vinculum in the male genitalia and the simple type female genitalia without specialization in the region of the ostium bursae. The genitalia structures of this group are similar to the species of sections I and II of Braun (1963).

Bucculatrix firmianella Kuroko (Plates 1(1), 2(1–11). Figs 3A–C, 10A)
(Japanese name “Aogiri-Chibiga”)

Bucculatrix exedra Meyrick, 1915 (misidentification): Issiki, 1950, in *Icon. Ins. Jap.*, (ed. 2): 443, f.1193; Inoue, 1954, *Check List Lep. Japan, Part 1*; Kuroko, 1957, *Enum. Ins. Mont. Hikosan*, 1. Lep. : 2; Issiki, 1957, in *Icon. Het. Jap. Col. Nat.*, 1: 19, Pl. 2, F. 59; Kuroko, 1964: 11–12.

Bucculatrix firmianella Kuroko, 1982: 172, Pl. 2: 29, 264: 4, 265: 1, Cat. 728.

Diagnosis. Forewing white mixed with obscure yellowish-brown. Male genitalia with socius and valva oblong and rounded at apex; aedeagus long and slender. Female genitalia with ostium bursae slender and tubular; antrum (posterior part of ductus bursae) very long, slender and plate-like.

Male genitalia (Figs 3A–C).

Female genitalia (Fig. 10A).

Distribution. Honshu, Shikoku, Kyushu.

Host plant. *Firmiana simplex* (L.) W. Wight (Japanese name: Aogiri), Sterculiaceae.

Material examined—60 (30 ♂ 30 ♀)

All of the following materials were collected from the same host plant *Firmiana simplex*

“Aogiri”: Osaka Pref.: [All materials were collected in Osaka Pref. Univ., Sakai (S. Kobayashi)]: 4♂, 6♀, 27–29. v. 2007 em., 22. v. 2007 (larva); 1♂, 2. vi. 2007 em., 22. v. 2007 (larva); 1♂1♀, 2. viii. 2007 em., 17. vii. 2007 (larva); 1♂1♀, 16. viii. 2007 em., 8. viii. 2007 (larva); 2♂, 1–2. ix. 2007 em., 20. viii. 2007 (larva); 1♂, 6. ix. 2007 em., 27. viii. 2007 (larva); 4♂8♀, 10–14. xi. 2007 em., 23. x. 2007 (larva); 2♀, 22, 29. xi. 2007 em., 29. x. 2007 (larva); 2♂, 1–3, 15–16. xii. 2007 em., 23. x. 2007 (larva); 2♂4♀, 5, 11–16, 22–29. xii. 2007 em., 29. x. 2007 (larva); 1♀, 11. i. 2008 em., 29. x. 2007 (larva); 1♀, 14. i. 2008 em., 23. x. 2007 (larva); 4, 29–30. v. 2008 em., 15. v. 2008 (larva); 3♂1♀, 2–3. vi. 2008 em., 15. v. 2008 (larva); 2♂1♀, 28. v. 2009 em., 18. v. 2009 (larva); 2♂1♀, 2&7. vi. 2009 em., 18. v. 2009 (larva); Wakayama Pref.: 1♂, 2♀, Musota, Wakayama, 5–7. iv. 2007 em. (S. Kobayashi & T. Hirowatari), 28. iii. 2007 (Cocoon).

1♀, Nôgawa, Wakayama, 5. vi. 2007 em. (M. Murase), 27. v. 2007 (Cocoon).

Biology. Kuroko (1964, 1982) recorded the biology of this species. In this study, the larvae were observed from May to October in 2007 in Osaka, and the adults emerged in the same season. Larvae collected in October 2007 emerged in December 2007 and January 2008 in the laboratory. The mine (on *Firmiana simplex*) is of a spiral linear type. Ten to 80 mines were observed in a leaf of the host plant. This species attains high population levels from summer to autumn in Osaka.

Remarks. This species can be distinguished from other species by the oblong socii and the elongate aedeagus in the male genitalia, and the largest scale sac among Japan species with long scales. Kuroko (1964) supposed that it may be an ancient species in Section VIII of Braun (1963).

Bucculatrix hamaboella Kobayashi, Hirowatari and Kuroko (Plates 1(2), 2(12–17). Figs 1D, 3D–F, 10B)

(Japanese name “Hamabo-Chibiga”)

Bucculatrix sp.: Murase & Takasu, 2007: 373, figs 1,2.

Bucculatrix hamaboella Kobayashi, Hirowatari and Kuroko, 2009: Kobayashi, Hirowatari, Murase & Kuroko, 2009: 84–90, figs 1–7.

Diagnosis. Forewing creamy white, mixed with dark brown. Male genitalia with socius and valva oblong; valva with a blunt conical seta at apex. Female genitalia with signum a series of radiating cancellous lines.

Male genitalia (Figs 3D–F).

Female genitalia (Fig. 10B).

Distribution: Honshu (Mie and Wakayama Prefs.)

Additional material to Kobayashi *et al.* (2009)– 3 (1♂2♀)

1♂2♀, Naize, Minamiise, Wataragi, Mie, 8–9. vii. 2009 em. (K. Nakano). Host: *Hibiscus hamabo*.

Host plant: *Hibiscus hamabo* Siebold et Zucc. (Japanese name: Hamabo), Malvaceae.

Remarks. This species was recently described by Kobayashi *et al.* (2009). The genital structure is similar to that of some species (e.g. *B. plucheae* Braun, 1963) in Sections I and II of Braun (1963), but it is distinguished by the differently shaped socius and valva.

Kobayashi *et al.* (2009) noted that the feeding habit of *B. hamaboella* is unique in that, 1)

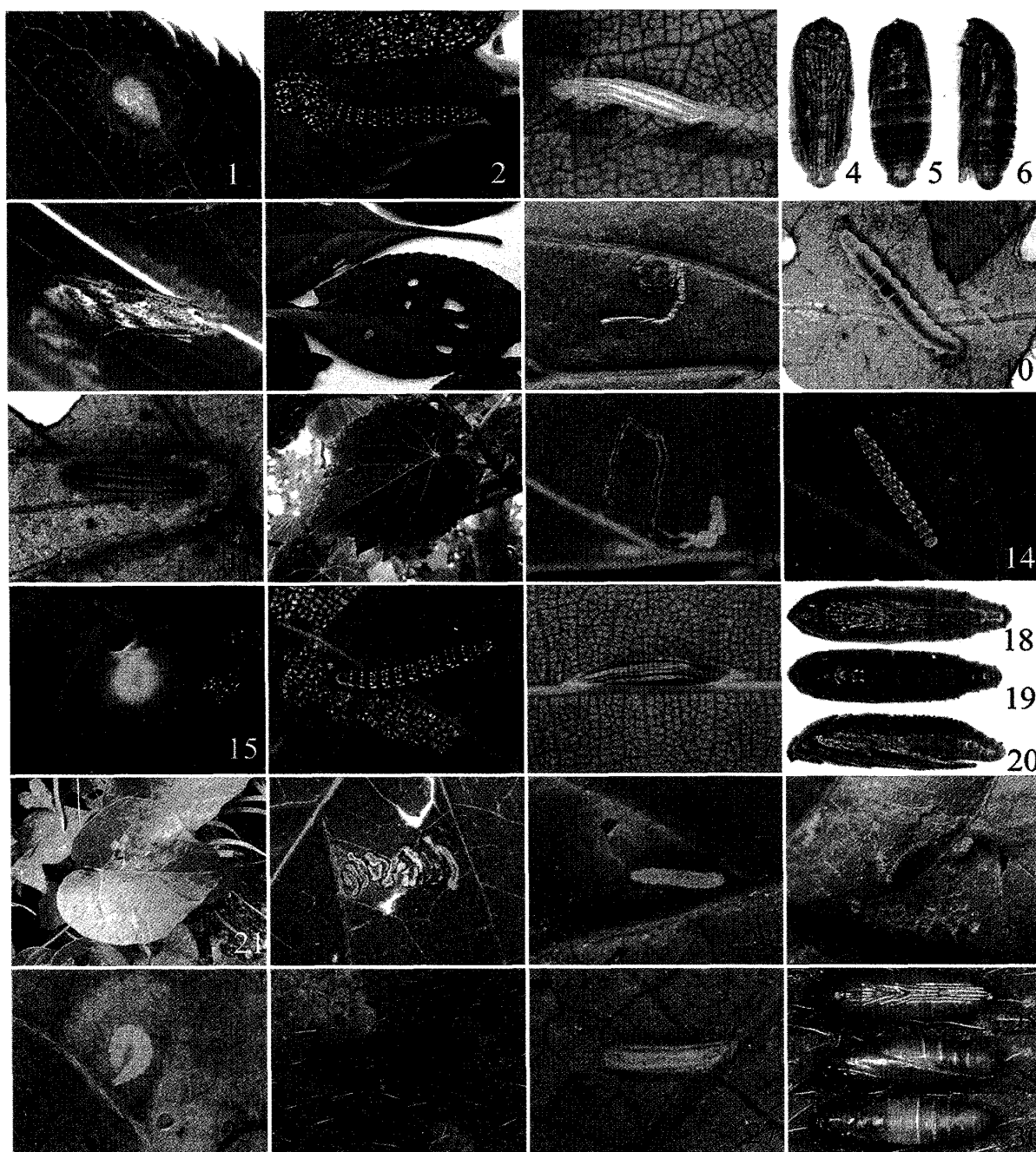


Plate 3. Immature stages of *Bucculatrix* spp. and the hostplants. 1–7. *B. pyrivorella* and *Prunus* × *yedoensis*. 8–11. *B. citima* and *Rhamnus japonica* var. *decipiens*. 12–20. *B. armata* and *Tilia japonica*. 21–30. *B. univoca* and *Ipomoea congesta*. 1: 3rd instar larva within 2nd cocoonet. 2: 4th instar larva. 3. 11, 17, 27: Cocoon. 4, 18, 28: Pupa (ventral view). 5, 19, 29: *Ditto* (dorsal view). 6, 20, 30: *Ditto* (lateral view). 7: Resting posture of the adult. 8, 12, 21: Hostplant, leaf and mine. 9, 13, 22: Spiral linear mine by young larva. 10, 16, 26: Final instar larva. 14, 24: Penultimate instar larva. 15, 25: Penultimate instar larva in 2nd cocoonet. 23: Later larva, emerging 1st cocoonet.

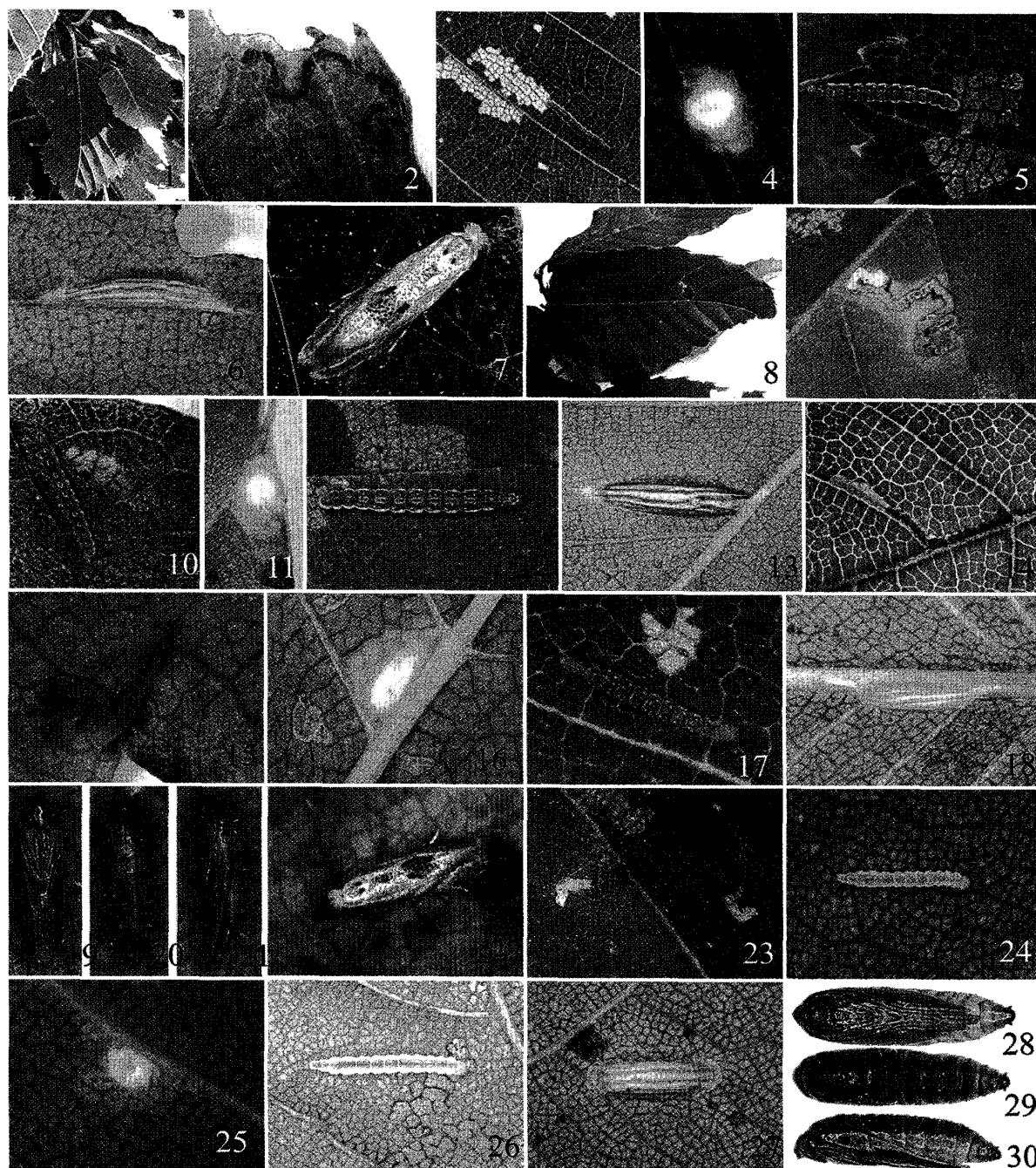


Plate 4. Immature stages of *Bucculatrix* spp. and the hostplants. 1–7. *B. demaryella* and *Betula platyphylla* var. *japonica*. 8–13. *Ditto* and *Castanea crenata*. 14–22. *B. serratella* sp. nov. and *Zelkova serrata*. 23–30. *B. thoracella* and *Tilia japonica*. 1: Hostplant, leaf and mine. 2, 9, 14, 23: Spiral linear mine by young larva. 3, 10, 15, 24: Young (2nd instar) larva. 4, 12, 17, 26: Penultimate instar larva in 2nd cocoonet. 5, 12, 17, 26: Final instar larva. 6, 13, 18, 27: Cocoon. 19, 28: Pupa (ventral view). 20, 29: *Ditto* (dorsal view). 21, 30: *Ditto* (lateral view). 7, 22: Resting posture of the adult.

the young larva is a leaf miner forming a long red linear mine but in the later instars the larva becomes a stem borer; 2) later instar larvae undergo double molts within a cocoonet (moulting cocoon); and 3) penultimate and final instars appear on the surface of the leaf as non-feeding stages. Recently the later instar larvae were observed feeding also within flower bud of *H. hamabo* in Mie Pref. (Nakano & Mano, unpublished).

Group 2

Group 2 includes seven species: (i) *B. splendida* Seksjaeva, 1992 (Host: *Artemisia princeps* Pampan., Asteraceae); (ii) *B. laciniatella* Benander, 1931 (Host: Unknown); (iii) *B. sp. 1* (Host: Unknown); (iv) *B. maritima* Stainton 1951 (Host: *Aster tripolium* L., Asteraceae); (v) *B. notella* Seksjaeva, 1996 (Host plant: *A. princeps*); (vi) *B. nota* Seksjaeva, 1989 (Host: *A. princeps*); and (vii) *B. sp. 2* (Host: Unknown). The male genitalia are characterized by the valva tapering towards the apex (some species have short conical setae at apex), the broad tegumen + uncus, and the long, sinuate aedeagus. The female genitalia are characterized by the strongly sclerotized apophyses anteriores and long apophyses posteriores, sclerotized ostium bursae, and the specialized scales each side of the ostium. This group is equivalent to the Asteraceous-feeding species of section II of Braun (1963) and the *B. gnaphaliella* group of Baryshnikova (2008).

Bucculatrix splendida Seksjaeva (Plates 1(3), 2(18-20). Figs 1C, 3G-I, 9E, 10C)
(Japanese name “Haiiro-Chibiga”)

Bucculatrix splendida Seksjaeva, 1992: 426, fig.4; Seksjaeva, 1996: 887, fig.4.

Bucculatrix sp. 4: Oku, 2003: 13 [examined].

Diagnosis. Forewing and vertex tuft fuscous brown. Male genitalia with socius short lobe; valva oblong and rounded at apex. Female genitalia with signum very small spines.

Description. Wing expanse 8.0 mm. Frons lustrous fuscous brown; vertex tuft raven-black. Eye-caps creamy white sprinkled ochreous scales. Antennae bronzy-gray. Thorax fuscous brown. Abdomen bronzy-gray. Anal tuft pale gray. Scale sac small.

Forewing fuscous brown, without any irrorations; cilia blackish-brown. Hindwing gray; cilia pale gray.

Male genitalia (Figs 3G-I, 9E). Socius a short lobe. Valva an oblong lobe, rounded at apex. Aedeagus long, sinuate toward left at apex; vesica slightly rolled. Juxta oblong, weakly sclerotized, tapering to the apex.

Female genitalia (Fig. 10C). On segment 8, a group of specialized long scales each side of ostium with short apophyses anteriores. Ostium bursae slightly depressed. Antrum oblong, sclerotized. Ductus bursae oblong. Corpus bursae globular with signum ribs closely placed, spines very small, converging posteriorly.

Distribution. Hokkaido (new record), Honshu: Iwate Pref. (Oku, 2003), Nagano Pref. (new record); Russian Far East (Seksjaeva, 1992)

Host plant. *Artemisia princeps* Pampan. (Japanese name: Yomogi), Asteraceae.

Material examined—7 (3 ♂ 4 ♀)

Hokkaido: 2 ♂, 1 ♀, Aikoku, Obihiro, 11–17. viii. 2008 em. (S. Kobayashi & T. Hirowatari). Host: *Artemisia princeps*, 5. viii. 2008 (larva). Iwate Pref.: 1 ♂, Tsunatori, 28–29. v. 1995. (N. Doi). Genital plate no. M-00141 of Oku (2003). Nagano Pref.: [N. Hirano leg.]: 1 ♂,

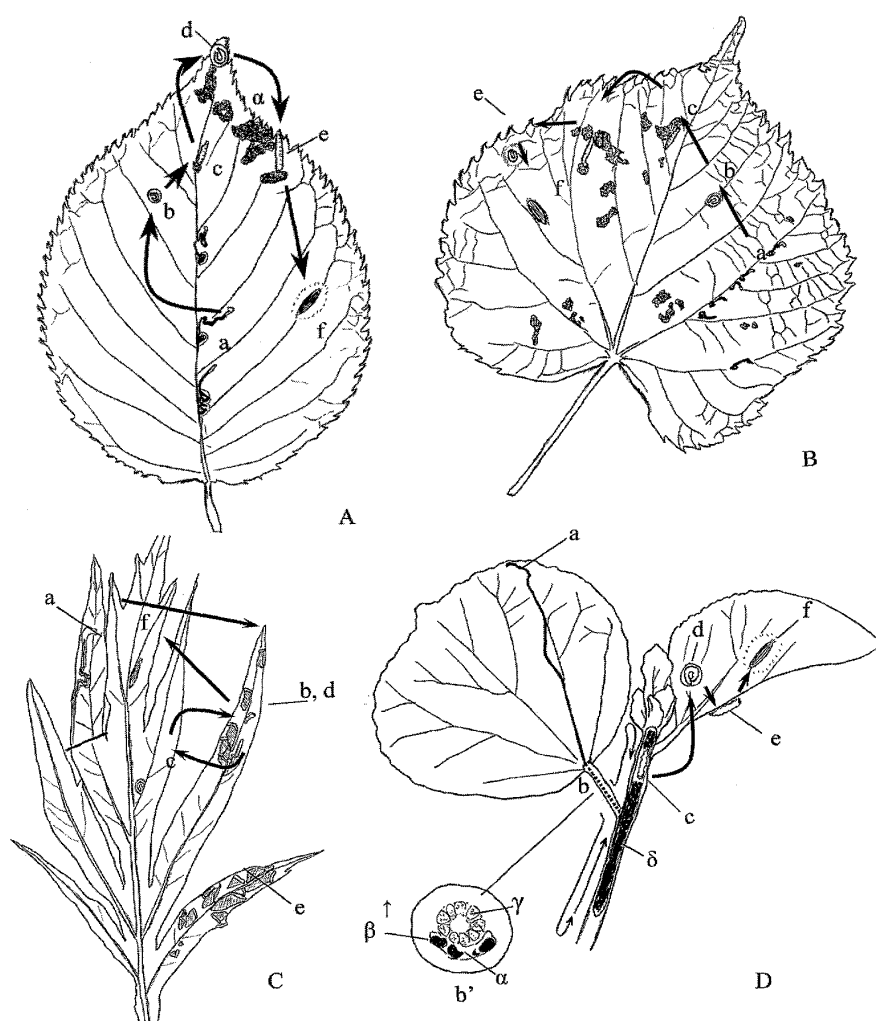


Fig. 1. Hostplant, immature stage and biology of *Bucculatrix* spp.

A. *B. pyrivorella* on the leaf of *Prunus* × *yedoensis* (a) Leaf mine by young larva. (b) 2nd instar larva within a first cocoonet, undergoing second molt. (c) 3rd instar larva feeding on leaf tissues. (d) 3rd instar larva within a second cocoonet, undergoing third molt. (e) 4th (final) instar larva feeding on leaf tissues. (f) Cocoon.

B. *B. thoracella* on the leaf of *Tilia japonica*. (a) Leaf mine by young larva. (b) 2nd instar larva within a first cocoonet, undergoing second molt. (c) 3rd instar larva feeding on leaf tissues. (d) 3rd instar larva within a second cocoonet, undergoing third molt. (e) 4th (final) instar larva feeding on leaf tissues. (f) Cocoon.

C. *B. splendida* and *B. notella* on the leaf of *Artemisia princeps*. (a) Leaf mine by young larva. (b) The young larva (presumably 2nd instar) feeding on leaf tissues. (c) The young larva (presumably 2nd instar) within a cocoonet, undergoing second molt. (d) The final larva (presumably 3rd instar) feeding on leaf tissues. (e) Feeding damage of *B. splendida* (f) Cocoon.

D. *B. hamaboella* in young shoot of *Hibiscus hamabo* (after Kobayashi *et al.* 2009) (a) Leaf mine by young larva. (b) Leafstalk mine by young larva. (b') cross section view of leafstalk (↑adaxial side); α) leafstalk mine by young larva. β) frass of the young larva γ) vascular bundle. (c) The later instar larva, boring into young stem. δ) frass of the later instar larva. (d) The later / semifinal instar larva within cocoonet, undergoing double molts. (e) External larva (final instar), appearing as non-feeding stage. (f) Cocoon. Arrows showing larval transfer.

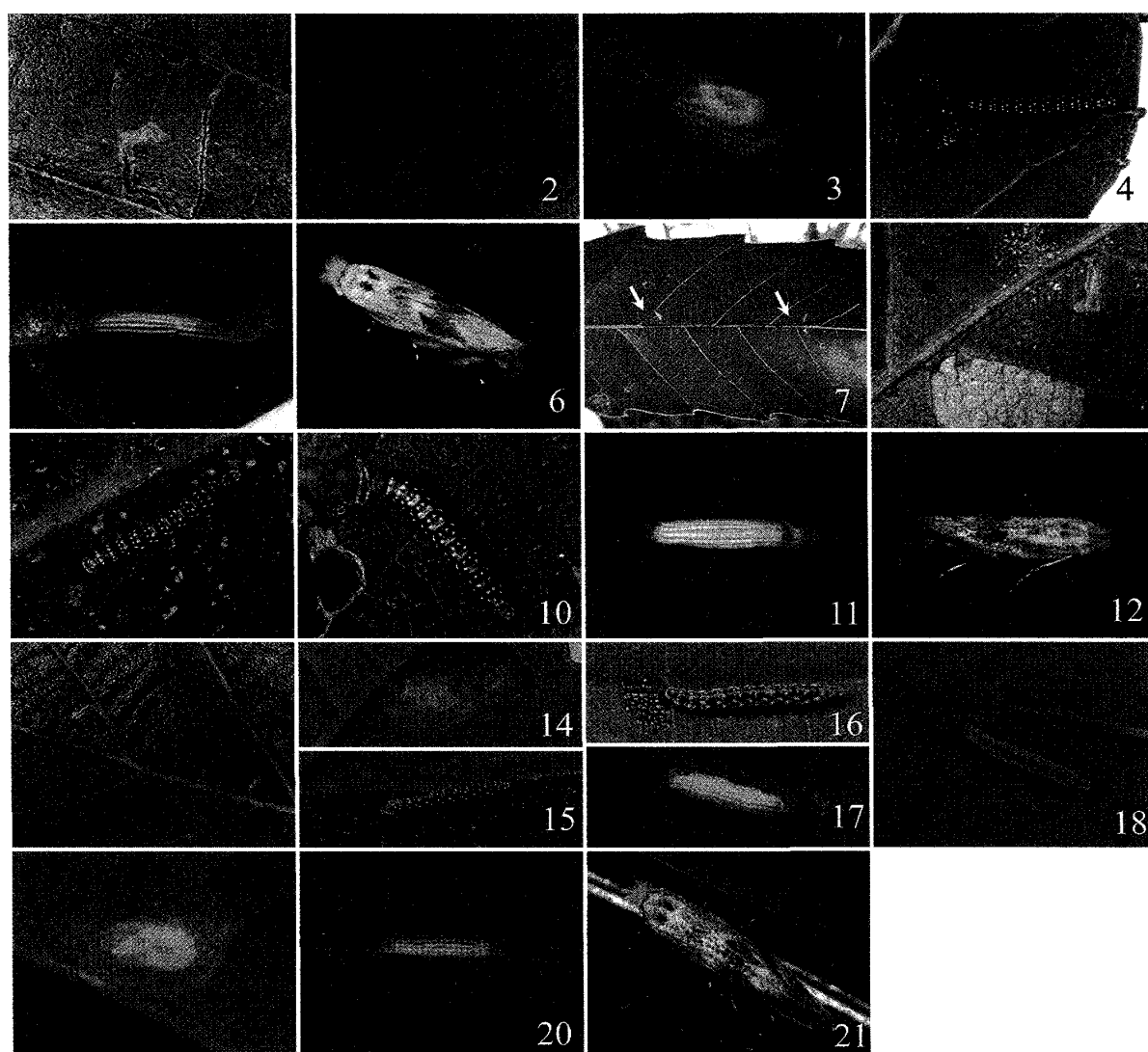


Plate 5. Immature stages of *Bucculatrix* spp. and the hostplants. 1–6. *B. muraseae* sp. nov. and *Alnus japonica*. 7–12. *B. tsurubamella* sp. nov. and *Quercus acutissima*. 13–17. *B. comporabile* and *Quercus dentata*. 18–21. *B. comporabile* and *Q. crispula*. 1, 8, 13: Spiral linear mine by young larva. 2, 9, 15, 18. Young (2nd instar) larva. 3, 19: Penultimate instar larva in 2nd cocoonet. 4, 10, 16: Final instar larva. 5, 11, 17, 20: Cocoon. 6, 12, 21: Resting posture of the adult. 7: Hostplant, leaf and mine. Arrows pointing to leaf mines. (13–20: photographs taken by H. Kogi)

Komoro, Azusagawa Vil., 12. vii. 1994 em. Host: *Artemisia princeps*, 3. vii. 1994 (cocoon); 1 ♀, Kamanosawa, Azusagawa Vil., 21. viii. 1977; 1 ♀, Same locality, 21. viii. 1991; 1 ♀, Same locality, 10. viii. 2002.

Biology. The young larva is a leaf miner, forming a linear mine (ca. 30–40 mm in length); one mine is usually found in a leaf. In the later instars (presumably 2nd and 3rd instars), as an external feeder, the larvae peel away and roll up the lower epidermis intact, and eat irregular patches of the leaf tissue, leaving the upper epidermis intact. The later instar larva of the external feeding stage is pale cream yellow in coloration, about 3.5–4.0 mm in length. The final instar is dark yellowish green in coloration and about 5.5–6.0 mm in length. On the lower surface of the leaf, later instars (presumably 2nd instars), spin a thin, flattened,

whitish cocoonet (about 3.0–4.0 mm in diameter). The final instar larva spins an elongate cocoon on the lower surface of the leaf. The cocoon is white (ca. 6.0 mm in length, 1mm in width).

Remarks. The genital structure of this species is similar to that of some species, e.g. Section II of Braun (1963) and *B. nigricomella* (Zeller, 1839) in the *B. gnaphaliella* group of Baryshnikova (2008), which may indicate its close relationship to them. But this species is distinguished by the small socius and the long aedeagus, which is three times the length of the valva. In Iwate Pref., Oku (2003) collected adults and recorded them as *B. sp. 4*, “Haiiro-Chibiga”. Examination of the male genitalia reveals that it is conspecific with *B. splendida* Seksjaeva, 1992.

Bucculatrix laciniatella Benander (Plate 1(4). Figs 3J-L)

(Japanese name “Azusagawa-Chibiga”)

Bucculatrix laciniatella Benander, 1931: 48–54; Seksjaeva, 1989a: 193, 197, fig. 144-2.

Diagnosis. Forewing white, mixed with light brown oblique streaks. Male genitalia with valva tapering from middle to apex, with some conical setae at apex. Aedeagus long with strongly curved apex.

Description. Wing expanse 9 mm. Frons lustrous cream-ocherous; vertex tuft light-brown. Eye-caps light brown. Antennae golden brown. Thorax light brown, scattered with creamy-white scales. Abdomen fuscous white. Anal tuft pale white to brown. Scale sac small.

Forewing creamy white, with a few light brown irrorations; one obscure light brown streak from costa at 3/5 to distal area, another from costa at 2/5 to dorsum; one obscure light brown patch from costa at 4/5 to termen, another from dorsum at 1/2 to median area; one light brown streak from base to 1/2, another along fold from base; one black plical dot on dorsum at 1/2, another near middle at 4/5, another at termen; cilia white to gray. Hindwing gray; cilia pale gray.

Male genitalia (Figs 3J-L). Socius short, rounded at apex. Valva separated from vinculum, tapering from middle to apex, and some conical setae at apex. Juxta oblong trapezoid, weakly sclerotized. Aedeagus long with strongly curved apex.

Distribution. Honshu (Nagano Pref.); Europe.

Hostplant. Unknown in Japan. Larvae mine leaves of *Artemisia laciniata* in Northern Europe (Seksjaeva, 1989a).

Material examined—2 (1 ♂ 1 ♀)

Nagano Pref.: 1 ♂, Ueno, Azusagawa, 4. vii. 1979 (N. Hirano); 1 ♀, same locality, 5. vi. 1982 (N. Hirano).

Biology. Unknown in Japan.

Remarks. The genital structure of this species is similar to that of some species whose larvae mine asteraceous plants (e.g. *B. splendida* Seksjaeva, 1992) in Sections II of Braun (1963) and the *B. gnaphaliella* group of Baryshnikova (2008).

Bucculatrix sp. 1 (nr. *bicinica* Seksjaeva) (Fig. 9D)

Bucculatrix sp. 3: Oku, 2003: 13 [examined].

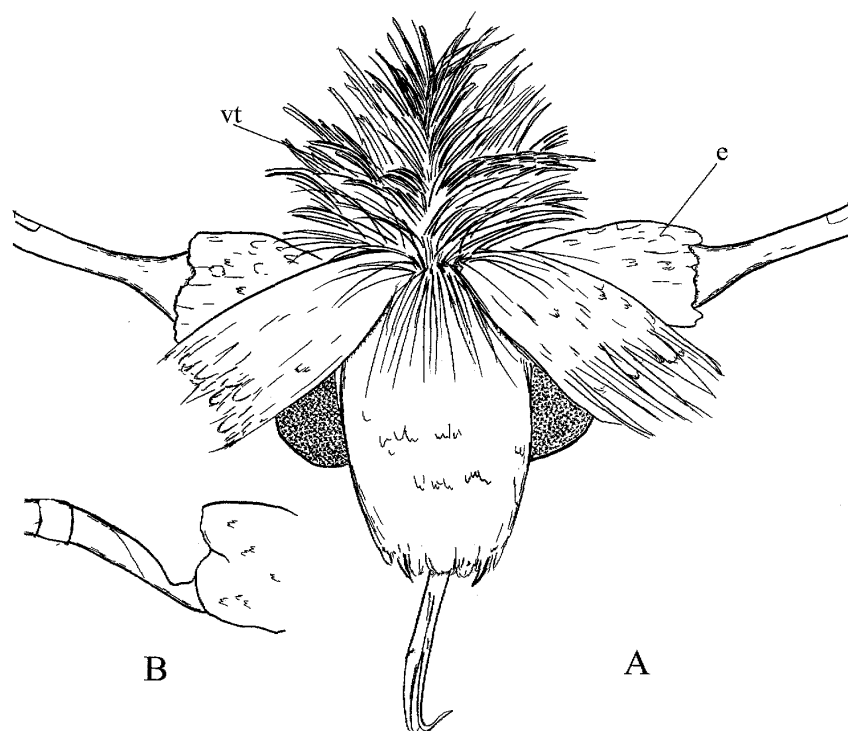


Fig. 2. Head of *Bucculatrix pyrivorella*. A. Front view, female. B. Eye-cap, pedicel and two segments of flagellum, male, showing notch in the first flagellomere. vt: vertex tuft; e: eye-cap.

Diagnosis. Male genitalia with valva oblong. Aedeagus very long and slender with strongly rolled apex.

Male genitalia (Fig. 9D).

Distribution. Honshu (Iwate Pref.) (Oku, 2003).

Host plant. Unknown.

Material examined—1 ♂

1 ♂, Takayashiki, Morioka, 19. vi. 1993. (Doi). genitalia slide no. M-00243 of Oku (2003).

Biology. Unknown.

Remarks. The genital structure of this species is very similar to that of *B. bicinica* Seksjaeva, 1992. Oku (2003) noted that the genital structure of this species is similar to that of *B. gnaphaliella* (Treitschke, 1833) belonging to the *B. gnaphaliella* group of Baryshnikova (2008). Since only one damaged specimen was available to examine, we treat it as an unidentified species.

Bucculatrix maritima Stainton (Plates 1(5), 2(21, 22). Figs 9A, 10D)
(Japanese name “Uragiku-Chibiga”)

Bucculatrix maritima Stainton, 1851: *Cat. Suppl.*: 11; Seksjaeva, 1981: 136–148; Seksjaeva, 1989a: 182, 197, fig. 141–3.

Diagnosis. Forewing chocolate brown, with white pattern, basal white streak distinct. Male genitalia with deeply notched valva at apex. Socius a short and slender cone. Female geni-

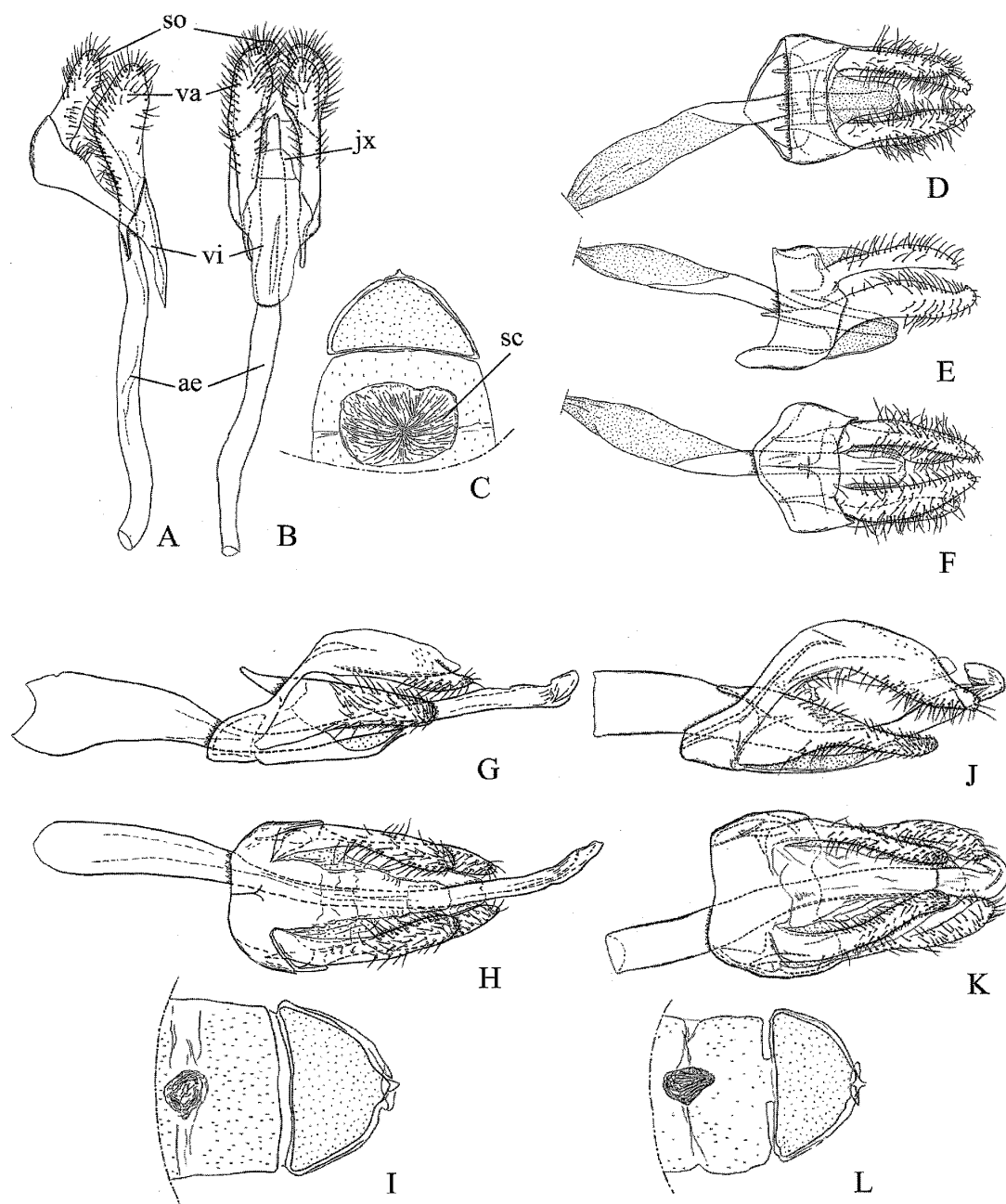


Fig. 3. Male genitalia and abdominal scale sac of *Bucculatrix* spp. A–C. *B. firmianella*. D–F. *B. hamaboella*. G–I. *B. splendida*. J–L. *B. laciniatella*. A, E, G, J: Whole genitalia, latetral view. B, F, H, K: Ditto, ventral view. C, I, L: Scale sac, dorsal view. D. Whole genitalia, dorsal view. so: socius; va: valva; vi: vinculum; ae: aedeagus; jx: juxta; sc: scale sac.

talia with bowl-shaped ostium bursae.

Male genitalia (Fig. 9A).

Female genitalia (Fig. 10D).

Distribution: Hokkaido, Honshu (Osaka Pref.); Europe (except south) (Seksjaeva, 1989a); Russia (Seksjaeva, 1981).

Host plant. *Aster tripolium* L. (Japanese name: Uragiku), Asteraceae in Japan.

Material examined—2 (1 ♂ 1 ♀)

Hokkaido: 1 ♂, Kitaurimaku, Shikaoi, 28. vii. 2006. (H. Kogi). genitalia slide no. 6313 of Kogi;

Osaka Pref.: 1 ♀, Hokko, Konohana, Osaka, 20–23. x. 2009 em. (K. Yamazaki), Host: *Aster tripolium*, 19. x. 2009 (Cocoon).

Leaf and stem mines: Yodogawa River, Konohana-Umeda, Osaka, 5. xi. 2009 (S. Kobayashi & N. Kawasaki).

Biology. Cocoons on leaves and trunk were collected by K. Yamazaki in Osaka Pref., in October. We were unable to collect larvae or cocoons, and only succeeded in collecting old leaf mines. Leaf and stem mine: slender linear dark-red mine (ca. 40–50 mm in length), often tortuous along the midrib; 1–8 mines were usually observed in a leaf, especially at the base of the leaf. The cocoon is white to fuscous in coloration, about 8.0 mm in length, 1.0 mm in width.

Remarks: The genital structure of this species is very similar to that of *B. latviaella* Šulcs, 1990 and some species of Section II of Braun (1963) and the *B. gnaphaliella* group of Baryshnikova (2008). This species is distinguished by the slender, short aedeagus.

In Europe, the larvae of this species are known as leaf miners of the salt marsh halophyte, *Aster tripolium* (Hemminga & Soelen, 1992) and *Artemisia maritima* (Parenti, 2000). The young larva is a leaf miner of *Aster tripolium*, later instars subsequently making one or more shorter mines or feeding exposed, skeletonizing the leaf tissue. *B. maritima* completes two developmental cycles per year in salt marshes in the south-west Netherlands. Eclosion of larvae from the eggs is followed by a first growth phase in autumn. The winter probably is passed mostly in the 3rd instar stage, and larval development is completed in spring of the next year (Jansen & Hemminga, 1988; Hemminga & Soelen, 1992).

In Japan, K. Yamazaki (pers. comm.) collected leaf and stem mines and cocoons of this species in the south area of a landfill site at Hokko, Konohana, Osaka Prefecture. He observed mines and characteristic cocoons of *Bucculatrix*. The cocoonet was not observed in this study. *Aster tripolium* is an endangered species due to the modification of rivers and land development according to the Red data Book (Ministry of Environment, 2000).

Bucculatrix notella Seksjaeva (Plates 1(6), 2 (23–28). Figs 1C, 4A–D, 10E)
(Japanese name “Yomogi-Chibiga”)

Bucculatrix notella Seksjaeva, 1996: 884, fig.1

Bucculatrix sp.: Murase, 2003: 3, fig. 2–9 [examined].

Diagnosis. Vertex tuft white, a chocolate brown cluster of scales in center. Forewing white, with chocolate brown or ochreous pale orange oblique streaks. Male genitalia with socius small and indistinct; tegumen + uncus broad, aedeagus long, sinuate. Female genitalia with ostium bursae very large and cup-shaped; antrum strongly sclerotized and bent to the right.

Description. Wing expanse 6.0–7.0 mm. Frons lustrous pale white; vertex tuft white, or white with a chocolate brown cluster of scales in center. Eye-caps white sprinkled with ochreous scales. Antennae pale ochreous ringed with fuscous to black. Thorax white, with some streaks of ochreous orange scales. Abdomen fuscous ochreous. Anal tuft fuscous.

Forewing white, chocolate brown (sometimes darker) or with pale orange ochreous oblique streaks and patches as follows; streaks: one narrow from costa at 1/3, second

broader from costa at 1/2, three broader from dorsum at 1/2; patches: from base to 1/3; black plical dot at middle termen, cilia white, ochreous toward apex. Hindwing whitish gray; cilia whitish gray.

Male genitalia (Figs 4A–D). Socius small and indistinct. Tegumen + uncus broad. Valva with short fine setae, costal margin curving to a small apical lobe, bearing short conical setae. Aedeagus long, sinuate, tapering and rolled at apex. Scale sac small.

Female genitalia (Fig. 10E). On segment 8, a group of specialized scales on each side of ostium, and near base, forming furrows each side. Ostium bursae very large and cup-shaped. Antrum strongly sclerotized and bent to the right. Ductus bursae slender. Corpus bursae globular with signum ribs closely placed, spines long, converging posteriorly.

Distribution: Hokkaido, Honshu (Nagano, Mie, Nara, Osaka, Wakayama, and Hyogo Prefs.), Kyushu; Russian Far East (Seksjaeva, 1996).

Host plant. *Artemisia princeps* Pampan. (Japanese name: Yomogi), Asteraceae.

Material examined—77 (31 ♂ 30 ♀, 16 exs)

Hokkaido : [H. Kogi leg.]: 1 ♀, Kamitonbetsu, 21. v. 2000; 1 ♂, Kunbetsu, Rikubetsu, 10. vii. 2002; 2 ♂, Sakae, Syosanbetsu, 27. viii. 2002; 2 ♀ 1 ex, Kitaurimaku, Shikaoi, 22&30. vii. 2005; 1 ♀, Tomamu, Shimukappu, 7. vii. 2004; 1 ♀, Katsuranosawa, Atsuta, 23. viii. 2001; 1, Same locality, 15. vii. 2007. 1 ♂, Kotan, Atsuta, 10. vii. 2003; [Shiratsukari, Atsuta]: 2 ♂, 17. vii. 2003;

1 ex, 7. vii. 2004; 1 ♀, 11. vi. 2005; 3 ♀, 27. viii. 2005; 6 ♂ 3 ♀, 21. v. 2006; 2 ♂ 1 ♀, Kamishibun, Iwamizawa, 18. viii. 2001; 1 ♂, Shiretsukari, Ishikari, 27. viii. 2000; 1 ♂, Shink, Ishikari, 3. vi. 2004; 1 ♂, Ishikari-coast, Ishikari, 12. viii. 2007; 1 ♂, Kotan, Atsuma, 16. viii. 2001; 1 ♀, Shizukawa, Tomakomai, 2. vii. 2003; 1 ♀, Same locality, 29. viii. 2003; 1 ♀, Yufutsu, Tomakomai, 12. ix. 2003; 1 ♂, Zenibako, Otaru, 2. v. 2001; 1 ♀, Bikuni, Syakotan, 19. vii. 2002; All of the following materials were collected from the same host plant *Artemisia princeps* “Yomogi”: 3 ♂ 3 ♀, Aikoku, Obihiro, 13–17. viii. 2008 em. (S. Kobayashi & T. Hirowatari). 5. viii. 2008 (larva). Nagano Pref. : [H. Kuroko leg.]: 4 exs, Yatsugatake, 21. x. 1966. 11. ix. 1966; 1, Yatsugatake, 29. ix. 1965. 7. ix. 1965; 1 ♂, 1 ex, Tateshina-kogen, 15. vi. 1968. 7. ix. 1965. Mie Pref. : 1 ♀, Aokawa, Sohara, Matsusaka, 16. x. 2007 em. (S. Kobayashi). 7. x. 2007 (Cocoon). Nara Pref. : 1, Imai, Soni, Uda, 30. vi. 2007 (S. Kobayashi) Adult on *Artemisia princeps*; 1 ♂, Yoshino, 10. x. 1968 (H. Kuroko). Osaka Pref. : 1 ex, Mt. Mikusa, Nose, 24–28. ix. 2007 em. (S. Kobayashi & T. Hirowatari). 19. ix. 2007 (larva); 1 ex, Same locality, 1. x. 2007 em. (S. Kobayashi & T. Hirowatari). 19. ix. 2007 (larva); 1 ex, Osaka, Pref. Univ. Sakai, 4–6. viii. 2007 em. (T. Hirowatari) 24. vii. 2007 (larva); 2 ♂ 1 ♀, same locality, 18. v. 2007 (LT). (N. Hari, T. Hirowatari, A. Nobuoka, Guo-Hua Hung, S. Kobayashi); 1 ♀, 18. vi. 2007 (LT). (same collectors). 2 exs, same locality, 4, 8. ix. 2007 em. (T. Hirowatari). 3. ix. 2007 (larva); 1 ♀, Kuwahata, 3. xii. 2005. (S. Koshino). Wakayama Pref.: [M. Murase leg.]: 1 ex, Nogawa, Wakayama, 27. v. 2002, 14. v. 2002 (larva), 16. v. 2002 (pupa); same locality: 1 ♂, 23. vi. 2002 em. 16. vi. 2002 (larva); 1 ex, 21. x. 2002 em. 19. x. 2002 (cocoon); 1 ♂, 5. xi. 2002. em. 7. x. 2002 (cocoon). 3 ♂, 4 ♀, Shionomisaki, Kushimoto, 2–6. viii. 2007 em. (S. Kobayashi & T. Hirowatari). 24. vii. 2007 (larva). Hyogo Pref.: 1 ex, Himeji, 5. ix. 1967 (Kamata). Kyushu: 1 ex, Safuri, 3. viii. 1959 (H. Kuroko).

Mie Pref.: Larva: 2, Nakachiyama, Nabari, Mie, 24. xi. 2007. (S. & T. Kobayashi).

Biology. Murase (2003) recorded the biology of this species. The young larva (presumably

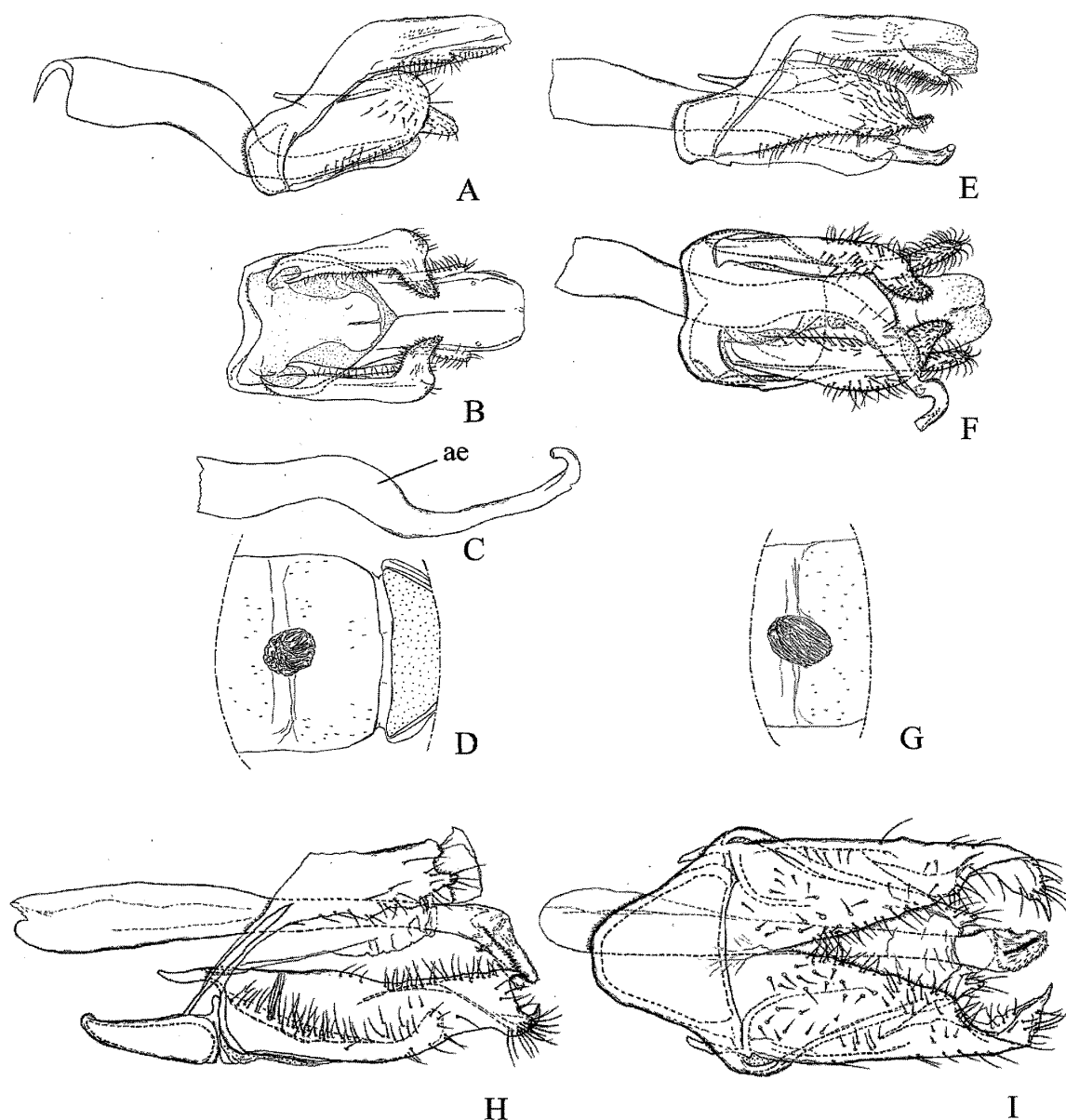


Fig. 4. Male genitalia and abdominal scale sac of *Bucculatrix* spp. A–D. *B. notella*. E–G. *B. nota*. H–I. *B. sinevi*. A, E, I: Whole genitalia, lateral view. B: Ditto, except aedeagus, ventral view. C: Aedeagus, ventral view. D, G: Scale sac, dorsal view. F, H: Whole genitalia, ventral view.

1st and 2nd instars) is a leaf miner, forming a linear mine (ca. ~15–20 mm in length); one mine is usually found in a leaf. In the later instars (presumably 2nd and 3rd instars), the larvae enter the leaf through circular holes and mine out the leaf tissue, with only the head and thorax inside the mine. The later and final instar larva of the external feeding stage has a coloration of light pale green, or yellowish green, and is about 4.0–5.0 mm in length. On the lower surface of the leaf it spins a thin, flattened, whitish cocoonet and molts. The final instar larva spins an elongate cocoon on the lower surface of the leaf. The cocoon is white (ca. 6.5 mm in length, 1 mm in width).

Remarks: The larval habits and forewing pattern of this species are similar to those of other species of leaf miners of *Artemisia*, but it can be distinguished by the tegumen + uncus

being developed to apex and the slender valvae in the male genitalia.

In the forewings, some distinct variations were recognized in the pattern of colors and patches in the specimens collected in summer.

In this study, early instar larvae were collected later in November from Mie Pref.. Murase (2003) recorded the larvae in early December and emerged adults in February from Wakayama Pref.. This species presumably overwinters in the larval stage. In Hokkaido, The larvae of *B. notella* and *B. splendida* were observed on leaves of *Artemisia princeps* in the same habitat. The species were difficult to distinguish from the leaf mines, but very easy from the larval feeding patches.

***Bucculatrix nota* Seksjaeva (Plate 1(7). Figs 1C, 4E-G, 9B)**

(Japanese name “Iwate-Yomogi-Chibiga”)

Bucculatrix nota Seksjaeva, 1989b: 622, fig. 4; Baryshnikova, 2005: 767–768, fig. 10.

Bucculatrix sp. 1: Oku, 2003: 13 [examined].

Diagnosis. Vertex tuft white, a chocolate brown cluster of scales in center. Forewing creamy white, mixed with chocolate brown. Male genitalia with valva narrowed at apex with short conical setae; aedeagus long, sinuate, uncate at apex.

Description. Seksjaeva (1989) described this species.

Male genitalia (Figs 4E-G, 9B): See Seksjaeva (1989).

Distribution. Honshu (Iwate (Oku, 2003), Nagano Prefs.); Russian Far East (Seksjaeva, 1989b).

Hostplant. *Artemisia princeps* Pampan. (Japanese name: Yomogi), Asteraceae (Oku, 2003).

Material examined 2 (2 ♂)

Iwate Pref.: 1 ♂, Morioka, 25. iv. 1972. (T. Oku). genitalia slide no. M-00140.

Nagano Pref.: 1 ♂, Shimashima-dani, Azumi, 18. v. 1996 (N. Hirano).

Biology. Oku (2003) recorded the biology of this species.

Remarks. The genital structure of this species is similar to that of some species whose larvae mine asteraceous plants (e.g. *B. notella* Seksjaeva, 1996) in the *B. gnaphaliella* group of Baryshnikova (2008) and Sections II of Braun (1963), but it is distinguished by the narrowed valva at apex and aedeagus being uncate at apex.

The larval habits and forewing pattern of this species are similar to those of other species of leaf miners of *Artemisia* (e.g. *notella* Seksjaeva; *nottei* Petry). Oku (2003) recorded that the adults had a summer form from Iwate Pref.

***Bucculatrix* sp. 2 (nr. *varia* Seksjaeva) (Fig. 9C)**

Bucculatrix sp. 2: Oku, 2003: 13 [examined].

Diagnosis. Male genitalia with socius basally rounded with a digitate lobe. Aedeagus sinuate, uncate at apex.

Male genitalia (Fig. 9C).

Distribution. Honshu (Iwate Pref.) (Oku, 2003).

Host plant. Unknown.

Material examined—1 ♂

1 ♂, Sotoyama-damu, Morioka, 15. viii. 1995. (Doi). genitalia slide no. M-00211 of Oku (2003).

Biology. Unknown.

Remarks. The genital structure of this species is very similar to that of *B. varia* Seksjaeva, 1992 (Oku, 2003). Because only one damaged specimen was available to examine, we treat it as unidentified species.

Group 3

Group 3 includes two species: (i) *B. sinevi* Seksjaeva, 1988 (Host: Unknown); (ii) *B. altera* Seksjaeva, 1989 (Host: Unknown). The genitalia of both sexes of this group have unique characters. In the male genitalia, the valva is strongly sclerotized and specialized, the socii are absent or very weakly developed, and the vinculum is broadly triangular. In the female genitalia, the lamella antevaginalis has a pair of horn-shaped processes. Baryshnikova (2008) included *B. sinevi* and *B. altera* in the *B. albedinella* group.

Bucculatrix sinevi Seksjaeva (Plate 1(8). Figs 4H–I, 10F)

(Japanese name “Shinefu-Chibiga”)

Bucculatrix sinevi Seksjaeva, 1988: 66–67, fig. 10; Baryshnikova, 2005: 767, fig. 5; Baryshnikova & Dubatolov, 2007: 47.

Diagnosis. Forewing creamy white, mixed with brown. Male genitalia with valva broad, two claws at apex. Female genitalia with lamella antevaginalis with a pair of curved horn-shaped processes.

Description. Wing expanse 7.0–8.0 mm. Frons creamy white; vertex tuft creamy white, mixed with ochreous scales centrally. Eye-caps white sprinkled with dark brown scales. Antennae ochreous ringed with fuscous to black. Thorax white, scattered on the anterior part with ochreous scales, posterior part with dark brown scales. Abdomen pale bronzy-gray. Anal tuft pale fuscous brown. Scale sac absent.

Forewing creamy white, with a few dark fuscous irrorations; one obscure dark brown streak or patch from costa at 2/3 to distal area, another from dorsum at 1/2 to termen; one obscure dark brown patch from base to costal fold, another at dorsum 1/3; one black plical dot on dorsum at 1/2, another in middle at 4/5; cilia white, ochreous toward apex. Hindwing gray; cilia pale gray.

Male genitalia (Figs 4H–I). See Kuznetsov *et al.*, (1988).

Female genitalia (Fig. 10F). See Baryshnikova (2005).

Distribution. Hokkaido; Russian Far East (Kuznetsov *et al.*, 1988).

Host plant. Unknown

Material examined—19 (13 ♂ 5 ♀, 1 ex)

Hokkaido: [H. Kogi leg.]: 1 ♀, Oiwake-touge, Erimo, 3. vii. 1993; 1 ♂, Komakusa, 11. vii. 1993; 1 ♂, Shiratsukari, Atsuta, 8. vii. 2001; 1 ♂, Kamishibun, Iwamizawa, 5. vii. 2008; 1 ♀, Manzi, Kuriyama, 4. vii. 2001; 1 ♂, Shinko, Ishikari, 4. vi. 2004; 3 ♂, Same locality, 11. vi.

2005; 1 ex, Tomikawa, Monbetsu, 5. viii. 2005 em. "Fuki-ura" 1 ♀, Horoman, Samani, 26. vi. 2001; 1 ♂, Same locality, 12. vi. 2004; 1 ♂, Sokawa, Shizunai, 12. vii. 1993; 1 ♂, Zenibako, Otaru, 2. viii. 2000; 1 ♂ 1 ♀, Same locality, 15. vi. 2003; 1 ♂ 1 ♀, Asari-Pass, Otaru, 13. vii. 2002.

Biology: Unknown.

Remarks. The genital structure of this species is similar to that of some species in the *B. albedinella* group in Baryshnikova (2008), but it is distinguishable from them by the characters shown in the diagnosis.

***Bucculatrix altera* Seksjaeva (Plate 1(9). Figs 5A-E, 11A)**

(Japanese name "Amûru-Chibiga")

Bucculatrix altera Seksjaeva, 1989b: 625, fig. 8; Baryshnikova, 2005: 767, fig. 4; Baryshnikova & Dubatolov, 2007: 47.

Diagnosis. Forewing white, mixed with chocolate to dark brown. Male genitalia with valva long, slender, acute towards apex; aedeagus long, with long series of spiny cornuti in vesica. Female genitalia with lamella antevaginalis trapezoid with a pair of straight horn-shaped processes; ductus bursae broad, curved and longitudinally folded.

Description. Wing expanse 7.0–8.2 mm. Frons white; vertex white mixed with dark brown scales centrally. Eye-caps white sprinkled with ochereous scales. Antennae ochereous-white ringed with light chocolate. Thorax white, scattered with brown scales. Abdomen bronzy-whitish gray. Anal tuft ochereous-white. Scale sac small.

Forewing white, with a few light ochereous oblique streaks and patches; cilia white. Hindwing ochereous gray; cilia whitish gray.

Male genitalia (Figs 5A-E). Socius absent. Valva long, slender, acute toward apex, with long setae basally. Aedeagus long, with many long series of spiny cornuti in vesica; juxta undeveloped; vinculum broad, nearly triangular. Scale sac small.

Female genitalia (Fig. 11A). See Baryshnikova (2005).

Distribution. Hokkaido; Russian Far East (Seksjaeva, 1989b).

Host plant. Unknown.

Material examined—15 (5 ♂ 10 ♀)

Hokkaido: 1 ♂, Koshimizu-cho, Miwa, Hokkaido, 29. viii. 1989. (♂) (S. Kawahara), OPU. [H. Kogi leg.]: 2 ♀, Kitawurimaku, Shikaoi, 18. viii. 2005; 1 ♂, Tobetsu, Makubetu, 8. vi. 2005; 2 ♂ 1 ♀, Kotan, Atsuta, 9&12. viii. 2002; 1 ♀, Takinoue, Yubari, 31. v. 2000; 1 ♀, Kamit betsu, T betsu, 11. viii. 2003; 1 ♂, Same locality, 10. vi. 2005; 2 ♀, Shinko, Ishikari, 4. vi. 2004; 1 ♀, Yunosawa, Hayakita, 1. vi. 2001; 1 ♀, Shizukawa, Tomakomai, 4. vi. 1994; 1 ♀, Fukui, Niseko, 4. viii. 2006.

Biology. Unknown.

Remarks. The genital structure of this species is similar to that of *B. albedinella* (Zeller, 1839). But it is unique in having the aedeagus with many long series of spiny cornuti on the vesica, and the lamella antevaginalis with a pair of straight horn-shaped processes.

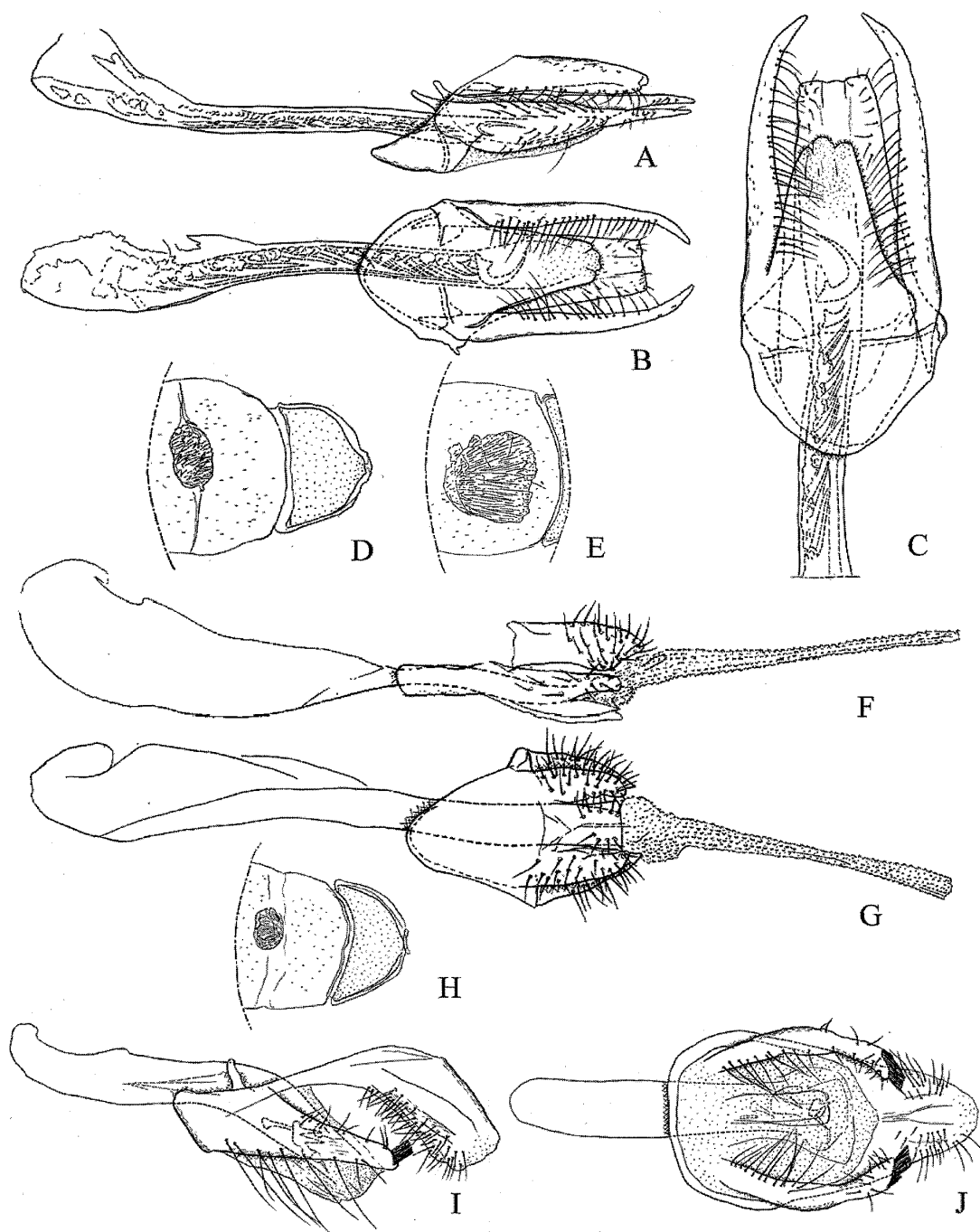


Fig. 5. Male genitalia and abdominal scale sac of *Bucculatrix* spp. A–D. *B. altera*. E–G. *B. pyrivorella*. H–J. *B. citima*. A, F, I: Whole genitalia, lateral view. B, C, G, J: *Ditto*, ventral view. D, E, H: Scale sac, dorsal view.

Group 4

Group 4 includes only one species: *B. pyrivorella* Kuroko, 1964 (Host: *Pyrus pyrifolia* (Burman f.), *Malus pumila* var. *domestica*, *Prunus* × *yedoensis* and *Malus sieboldii* Rehder, Rosaceae). The genital characters of both sexes of this group are given under the diagnosis of *B. pyrivorella*. This species was included in Section VI of Braun (1963) and the *B. basi-*

fuscella group of Baryshnikova (2008).

Bucculatrix pyrivorella Kuroko (Plates 1(10), 2 (29–32), 3 (1–7). Figs 1A, 2, 5E–G, 11B)
(Japanese name “Nashi-Chibiga”)

Bucculatrix crataegi Zeller 1839 (misidentification): Issiki, 1957: 18, pl. 2, fig. 58.

Bucculatrix pyrivorella Kuroko, 1964: 11, pls 5, 11, figs 34, 55; Kuroko, 1982: 172, Pl. 2: 28 (♂), 265: 3, Cat. 729.

Diagnosis. Vertex tuft creamy white, with an ochereous-orange cluster of scales in center. Forewing white mixed with ochereous-orange. Male genitalia with socius an indistinct lobe; valva very short, fused with vinculum. Female genitalia with ostium bursae very broad and cup-shaped; antrum bulging.

Male genitalia (Figs 5E–G).

Female genitalia (Fig. 11B).

Distribution. Hokkaido, Honshu, Shikoku, Kyushu; Korea Peninsula; Russian Far East (Seksjaeva, 1989b).

Host plant. *Pyrus pyrifolia* (Burman f.), *Malus pumila* var. *domestica*, *Prunus* × *yedoensis* (Japanese name: Nashi, Ringo, Sakura) and *Malus sieboldii* Rehder (Japanese name: Zumi), Rosaceae in Japan.

Material examined—17 (8 ♂♂, 8 ♀♀, 1 ex)

Hokkaido: [H. Kogi legs.] 1 ♂, Otonrui, Horonobe, 18. vi. 2004; 1 ♂, Shibi, Ishikari, 14. vi. 2006; 1 ♂, Horoman, Samani, 24. vi. 2007. Nagano Pref.: 1 ♂, Mt. Kogi, Horigane, 10. vii. 1999 (H. Okamoto); 1 ♂ 1 ♀, Okada, Matsumoto, 7, 10. v. 2000 (N. Hirano)., Host: *Malus sieboldii* 10. ix. 1999 (larva). Nara Pref.: 1 ♂, Shioi, Soni, Uda, 5. v. 2007 (S. & T. Kobayashi)., adult on *Prunus subhirtella* “Higannzakura”; 4 ♂♂ 5 ♀♀, Konagao, Soni, Uda, 5. v. 2008 (S. & T. Kobayashi)., Adult on *Prunus* × *yedoensis*; 2 ♀♀, 1 ex, Konagao, Soni, Uda, 26&30. vi. 2008. (S. & T. Kobayashi)., Host: *Prunus* × *yedoensis*, 15. vi. 2008 (larva); 1 ♂, Wasamata, Kamikitayama, 22. v. 2006 (T. Hirowatari & B. W. Lee).

Larvae: Imai, Soni, Uda, Nara, 9. ix. 2007 (S. Kobayashi).

Cocoons: Nogawa, Wakayama, 28. iii. 2007. (S. Kobayashi, T. Hirowatari & M. Murase). Osaka Pref. Univ., Sakai, Osaka, 6, 7. iv. 2007 (S. Kobayashi). Imai, Soni, Uda, Nara, 28. x. 2007 (S. Kobayashi).

Biology. Fujiie & Shimizu (1977) and Kuroko (1982) recorded the biology of this species. In this study, adults of overwintering generations were observed in early May in 2007 and 2008 in Nara Pref. The mine (on *Prunus* × *yedoensis*) is of a short serpentine type. 1–3 mines (ca. 20–30 mm in length) were observed on a leaf (usually midrib) of the host plant. The perimeter of the old leaf mines tended to turn brownish. First cocoonets (about 1.8–2.0 mm in diameter) were usually observed on the lower surface of the leaf, while 2nd cocoonets (about 3.0–4.0 mm in diameter) usually on the upper surface. The final instar larvae were coloured dark olive (ca. 5.5 mm in length).

Remarks. The genital structure of this species is similar to that of *B. crataegi* Zeller, 1839 and *B. pomifoliella* Clemens, 1860. But this species has the vesica without spines, and a very large scale sac on the male abdomen. Kuroko (1964) included this species in Section VI of Braun (1963).

Group 5

Group 5 includes only one species, *B. citima* Seksjaeva, 1989 (Host: *Rhamnus davurica* Pall. var. *nipponica*, *R. japonica* var. *decipiens*, Rhamnaceae). The genitalia of both sexes of this group have unique characters. In the male genitalia, the valva is arm-like terminating in heavy setae at the apex, the vinculum is very narrow, and the aedeagus has some large cornuti on the vesica. In the female genitalia, the antrum is well developed, broad, and longitudinally folded. *B. citima* is included in the *B. frangutella* group of Baryshnikova (2008).

Bucculatrix citima Seksjaeva (Plates 1 (11), 3 (8–11). Figs 5H–J, 11C)
(Japanese name “Kurotsubara-Chibigā”)

Bucculatrix citima Seksjaeva, 1989b: 624, fig. 6; Oku, 2003: 13.

Diagnosis. Forewing white with dark red brown streaks. Male genitalia with valva arm-shaped terminating in heavy setae at the apex; socius absent; aedeagus short, cylindrical with minute cornuti in groups in vesica. Female genitalia with ostium bursae wide; antrum very broad, longitudinally folded.

Description. Wing expanse 6.0–7.0 mm. Frons lustrous white; vertex tuft white, sometimes slightly mixed with brown scales centrally. Eye-caps white. Antennae ochereous white ringed with fuscous to black. Thorax ochereous white. Abdomen gray to ochereous white. Anal tuft ochereous white. Scale sac small.

Forewing white, with a few dark red brown irrorationes; dark red brown streaks from costa at 1/3 to middle, another from costa at 2/3 to near dorsal area; dark red brown patches from dorsum at 1/2; a black plical dot on dorsum at 1/2, another near dorsum at 4/5, some fuscous brown scales scattered at apex toward termen; cilia whitish ochereous, yellowish ochereous towards apex. Hindwings gray; cilia pale gray.

Male genitalia (Figs 5H–J). See Seksjaeva (1989b).

Female genitalia (Fig. 11C). Ostium bursae wide, deeply invaginated. Antrum very broad, longitudinally folded. Ductus bursae short. Corpus bursae globular with signum a series of wide rings; spines of signum ribs very short. Ductus seminalis broad towards corpus bursae.

Distribution. Hokkaido (new record), Honshu: Iwate Pref. (Oku, 2003), Nagano Pref. (new record); Russian Far East (Seksjaeva, 1989b).

Host plant. *Rhamnus davurica* Pall. var. *nipponica* (Japanese name: Kurotsubara), *R. japonica* var. *decipiens* (Jap. name: Kuroumemodoki) (new record), Rhamnaceae.

Material examined—27 (10 ♂ 15 ♀, 2 exs)

Hokkaido: [H. Kogi leg.]: 7 ♀ 2 ♂, Kunbetsu, Rikubetsu, 10. vii. 2002; 1 ♀, Chiyoshibetsu, Hamamasu, 30. v. 2002; 1 ♂, Same locality, 30. vii. 2002; 1 ♂, Tomikawa, Monbetsu, 8. viii. 2004; 1 ♀, same locality, 14. vi. 2005; 2 ♀, same locality, 28. ii. 2006 em. Host: *R. japonica* var. *decipiens*. 1 ♂, 1 ex, Sakae, Hayakita, 9, 21. x. 2002 em. Host: *R. japonica* var. *decipiens*; 1 ♂, Komasato, Chitose, 10. vi. 2003; 1 ♂, 1 ex, same locality, 7. viii. 2004 em. Host: *R. japonica* var. *decipiens*; 1 ♀, Shizukawa, Tomakomai, 20. vi. 1993; 1 ♂, Same locality, 26. viii. 2002; Nagano Pref.: 1 ♂, Tateshina, [Nagano] 6. ix. 1965 (H. Kuroko), Host: “Kurotsubara” [*Rhamnus davurica* Pall. var. *nipponica*]. [Host: *R. japonica* var. *decipiens*, N. Hirano leg.]: 2 ♀, Okuchizawa, Toyoshina, 7, 9. v. 1994 em. 11. x. 1993 (larva); 1 ♀, Ōnoda, Azumi, 13. viii. 1989 em. 4. viii. 1989 (pupa); 1 ♂, Okuchizawa, Toyoshina, 2. v. 2001 em. 21. x. 2000 (larva);

Biology. Oku (2003) recorded the biology of this species from *Rhamnus davurica* Pall. var. *nipponica*. In this study, Hirano (pers. comm.) examined the larva from *Rhamnus japonica* var. *decipiens* in Azumino City, Nagano Pref., and we reared the larvae in the laboratory in Osaka Pref. Univ. Kogi (pers. comm.) also reared this species from *Rhamnus japonica* var. *decipiens* and observed its biology in Hokkaido; this species has at least two generations a year in Hokkaido and Nagano Prefs. The young larva is a leaf miner, forming a steel gray spiral linear mine (ca. 15–30 mm in length) :1–2 mines were usually observed in a leaf. The penultimate and final instar larvae are pale cream yellow in coloration, about 3.0–4.0 mm (penultimate instar), 4.0–5.0 mm (final instar) in length. The 1st and 2nd cocoonets are usually on the lower surface of the leaf, very thin, flattened and white in coloration, about 1.2–1.5 mm (1st), 2.0–3.0 mm (2nd) in diameter. The cocoon is grayish brown or whitish wine red in coloration about 4.5–5.0 mm in length, 0.8–1 mm in width.

Remarks. The genital structure of this species is similar to that of *Bucculatrix frangutella* (Goeze, 1783), whose larvae mine leaves of buckthorn in Europe and central Asia (Seksjaeva, 1989a). But in the latter species, the vesica has two unguiculate cornuti. This species has shorter forewings than any other Japanese species.

Group 6

Group 6 includes only one species, *B. armata* Seksjaeva, 1989 (Host: *T. japonica* (Miq.) Simonk., Tiliaceae). The genitalia of both sexes of this group show characters shared with groups 4 and 5. In the male genitalia, the valva is very sclerotized and shaped like an arm, the vinculum is triangular, and the aedeagus has some large cornuti on the vesica. In the female genitalia, the antrum is developed, and is elongate, tapering to the ductus bursae with numerous longitudinally folds. *B. armata* is in the *B. armata* group of Baryshnikova (2008).

Bucculatrix armata Seksjaeva (Plates 1 (12), 3 (12–21). Figs 6A–C, 11D)
(Japanese name “Shinanoki-Chibiga”)

Bucculatrix armata Seksjaeva, 1989b: 623, fig. 5; Baryshnikova, 2005: 767, fig. 6.

Daiagnosis. Vertex tuft white with ochreous centrally. Forewing white, mixed with orange brown. Male genitalia with aedeagus broad toward base, one large acute cornutus. Female genitalia with antrum elongate, tapering to ductus bursae with numerous longitudinal folds.

Description. Seksjaeva (1989b) described the adult and male genitalia.

Male genitalia (Figs 6A–C). Socius absent. Valva strongly sclerotized, separated from vinculum, with two short claws at apex. Juxta triangular, weakly sclerotized. Aedeagus broadened towards base, one large acute cornutus at the middle of vesica; vesica protruding, verrucose. Scale sac large.

Female genitalia (Fig. 11D). See Baryshnikova (2005).

Distribution. Hokkaido; Russian Far East (Seksjaeva, 1989b).

Host plant. *Tilia japonica* (Miq.) Simonk. (Japanese name: Shinanonki), Tiliaceae.

Material examined—10 (2 ♂ 8 ♀)

Hokkaido: [H. Kogi leg. Host: *Tilia japonica*]: 1 ♂, Ishikari-coast, Ishiakri, 25. iii. 2007 em.; 1 ♀, Shibi, Ishikari, 14. ii. 2008 em.; 1 ♂ 5 ♀, same locality, 13–14, 23. iii. 2008 em.; 2 ♀, 10, 24. iv. 2008.

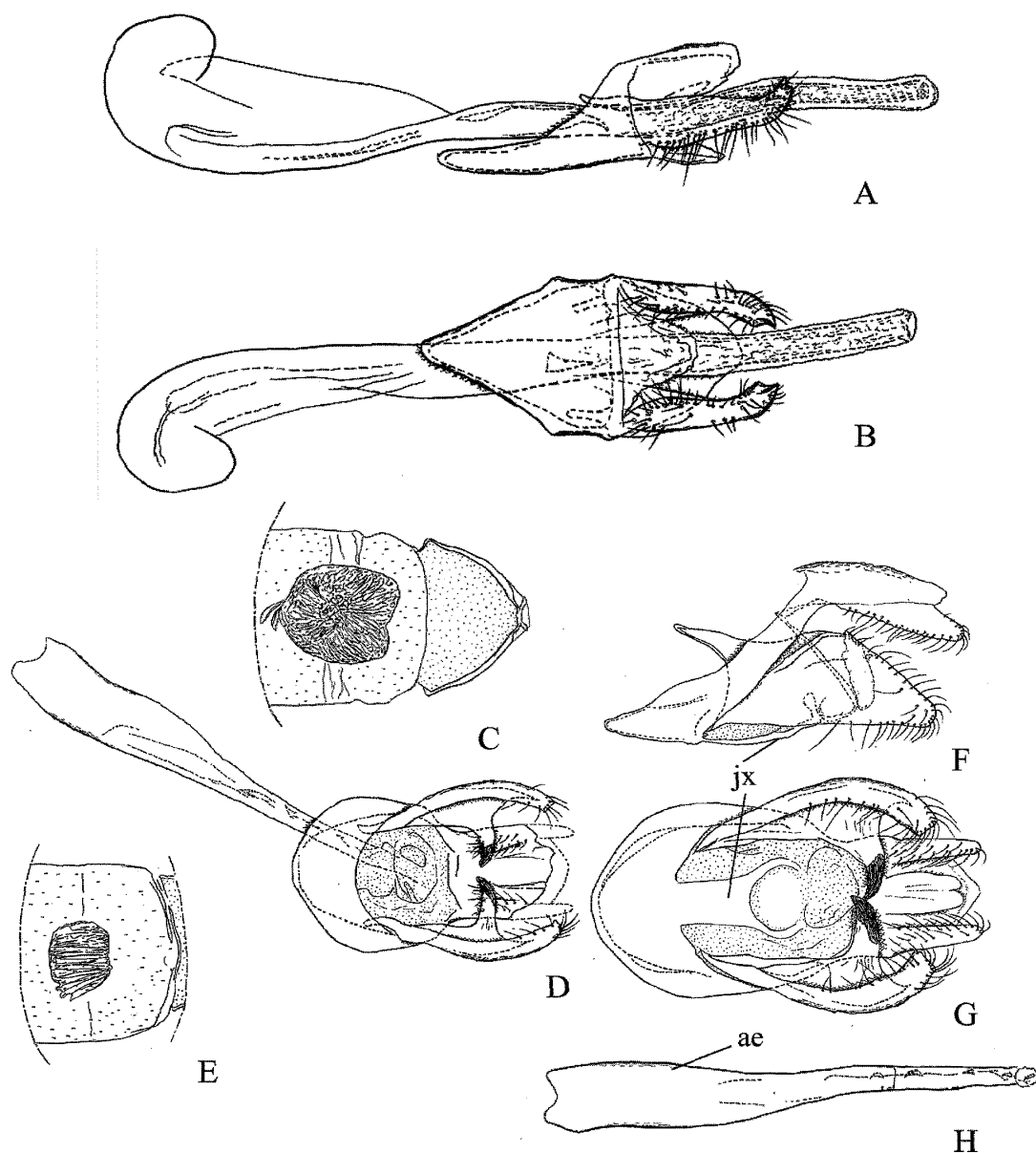


Fig. 6. Male genitalia and abdominal scale sac of *Bucculatrix* spp. A–B. *B. armata*. C–H. *B. univoca*. A, F: Whole genitalia, lateral view. B, D: *Ditto*, ventral view. C, E: Scale sac, dorsal view. G: Whole genitalia, except aedeagus, ventral view. H: Aedeagus, ventral view. ae: aedeagus; jx: juxta.

Larvae: 50 exs., Shibi, Ishikari City, Hokkaido, 7. viii. 2008 (S. Kobayashi, T. Hirowatari & H. Kogi).

Biology. The young larva forms a linear mine (ca. 10–20 mm in length); About 10–30 mines are usually found on a leaf. The penultimate instar larva is pale cream yellowish green (ca. 3.0 mm in length) and the final instar is pale olive in coloration (ca. 4.5–7.0 mm in length). The 1st and 2nd cocoonets are on the upper surface of the leaf, very thin, flattened and white or pale yellowish white in coloration, about 2.0 mm (1st), 4.0–5.0 mm (2nd) in diameter. The final instar larva spins a cocoon, usually on the upper surface of the leaf. The cocoon is Indian yellow in coloration (ca. 6.0 mm in length, 1 mm in width).

According to Kogi (pers. comm.) externally feeding larvae of this species were usually observed on the upper surface of the leaf in Hokkaido. On the other hand, larvae of another linden-feeding species, *B. thoracella*, feed on the lower surface of the leaf in the same linden. The number of larvae observed of this species was lower than for *B. thoracella*, but the larval population was much higher compared with other Japanese species.

Remarks. The genital structure of this species is similar to that of some species (e.g. *B. pomifoliella* Clemens, 1860) in the *B. bechsteinella* and *B. albedinella* groups (Baryshnikova, 2008). But this species is distinguished by the strongly sclerotized valva and absence of a socius. The linden-feeding species, *B. bisucla* Seksjaeva, 1989, has the structure of the male genitalia similar to *B. armata*, but the female genitalia have similar characters to the *B. lavaterella* group (Baryshnikova, 2005; 2008). Thus, *B. armata* might derive from rosaceous feeders by host shift.

Group 7

Group 7 includes only one species, *B. univoca* Meyrick, 1918 (Host plant: *Ipomoea congesta* (Burm.), *I. batatas* L., Convolvulaceae). The genitalia of both sexes have unique characters. In the male genitalia, the valva has an inwardly pointed hook. In the female genitalia, the apophyses anteriores are strongly sclerotized. The genitalia structures of this group are similar to the species of the *B. basifuscella* group of Baryshnikova (2008).

***Bucculatrix univoca* Meyrick** (Plates 1 (13), 3 (22–30). Figs 6D–H, 11E)

(Japanese name “Noasagao-Chibiga”)

Bucculatrix univoca Meyrick, 1918: *Exot. Micr.*, 2: 185; Fletcher, 1920, *Life his. Indian Ins. Micr.*, 4 (2): 215–216, Pl. LXVIII.

Diagnosis. Forewing blackish-brown, with black plical dots. Male genitalia with valva with an inwardly hooked process terminating in heavy setae. Female genitalia with posterior apophyses long and slender; antrum flat and sclerotized with lacinated lateral portions.

Description. Wing expanse 5.0–6.5 mm. Frons blackish-ocherous; vertex tuft blackish-brown. Eye-caps blackish-brown. Antennae brown ringed with fuscous to black. Thorax light brown. Abdomen gray. Anal tuft gray.

Forewing blackish-brown, black plical dots are as follows: one on dorsum at 1/2, another on costa at 2/3, with some black scales toward apex; cilia fuscous-white, blackish-ocherous towards apex. Hindwings gray; cilia gray. Scale sac large.

Male genitalia (Figs 6D–H). Socius short, narrow, on ventral sides of vinculum; basal inner wall extending inwards and articulated medially with a short rectangular process. Valva with an inwardly hooked process terminating in heavy setae. Juxta broad divided into 2 lobes at apex; vinculum semicircular ventrally. Aedeagus oblong, with a rather broad base, and at least five spiny cornuti in vesica.

Female genitalia (Fig. 11E). Papillae anales broad, posterior apophyses long and slender. Anterior apophyses reaching antero-lateral angles of segment 8; lamella antevaginalis membranous and half-moon like. Ostium bursae a canal-shaped invagination. Antrum flat and sclerotized with lacinated lateral portions. Ductus bursae slender and short. Corpus bursae globular with signum ribs sclerotized, spines acute.

Distribution. Kyushu (Kagoshima Pref.), Ryukyu (Okinawa Is. and Ishigaki Is. (Okinawa Pref.)); Taiwan (Taihoku), India.

Host plant. *Ipomoea congesta* (Burm.) and *I. batatas*, L. (Japanese name: Noasagao, Satsumaimo), Convolvulaceae in Japan.

Material examined—33 (4♂5♀, 28 exs)

Kagoshima Pref.: 1♂3♀, 12 exs, Okinoerabu-jima, China, 2, 6, 9. xi. 1965 (H. Kuroko). “Satsumaimo” [*Ipomoea batatas*] 13. x. 1965; 1 ex., same locality 9. xi. 1965 (H. Kuroko). “Satsumaimo” [*Ipomoea batatas*] 16. x. 1965. Okinawa Pref. : 2♂1♀, 7 exs, Tarama, Ishigaki, 3–9. x. 2007 em. (S. Kobayashi & T. Hirowatari). Host: *Ipomoea congesta*, 23. ix. 2007 (larva); 1♂1♀, 4 exs, same locality and host, 6–15. x. 2007 em. 24. ix. 2007 (larva); 4exs, Yaese, Okinawa Is., 20–21. vii. 2008 (S. Tominaga), Host: *Ipomoea congesta*. Taiwan: 1♂, Taihoku, 6. iv. 1933, (S. Issiki), “Satsumaimo” [*Ipomoea batatas*]”no” *Bucculatrix*.

Biology. Fletcher (1920) recorded the biology of this species from *I. reptans* Poir. in India. In this study, the young larva is a leaf miner, forming an intestinally coiled or spiral linear mine; blackish, about 30–60 mm in length, 1–4 mines on a leaf. The 3rd instar larvae are light yellowish-green, and final instar larvae light grayish black in coloration. The 1st and 2nd cocoonets, on the lower surface of the leaf, are thin, flated and coloration of white; larva within cocoonet is coloration of light pale yellow. The cocoon is found on the lower surface of the leaf along the vein, and is yellowish-ocherous.

Remarks. The genital structure of this species is similar to that of some species (e.g. *B. cantabricella* Chrétien, 1898) in *B. basifuscella* group of Baryshnikova (2008). But this new species is distinguished by the semicircular vinculum and aedeagus with spiny cornuti on the vesica.

Murase (pers. comm.) collected the larvae early in February in 2006 on the Okinawa Is. In this study, we collected them in September in 2007 in the Ishigaki Is. The adults may emerge throughout the season in the Ryukyus.

Group 8

Group 8 includes three species, (i) *B. demaryella* (Duponchel, 1840) (Host: *Castanea crenata* Sieb. et Zucc., Fagaceae. *Betula platyphylla* var. *japonica* (Miq) Hara., Betulaceae); (ii) *B. serratella* sp. nov. (Host: *Zelkova serrata* (thunb.) Makino., Ulmaceae); (iii) *B. kogii* sp. nov. (Host: Unknown). In the male genitalia, the valva is rounded at apex, the aedeagus tapers towards the apex, and the socius is long, slender, and rounded at apex. The male genitalia of Groups 8–10 have sclerotized juxta. This group has an especially strongly sclerotized juxta with an acute apex. In the female genitalia, the lamella antevaginalis is developed and strongly sclerotized. This group is equivalent to the species of section IV of Braun (1963) and the *B. demaryella* group of Baryshnikova (2008). Among them, *B. serratella* and *B. kogii* are very closely related to elm feeding species, e.g. *B. electa* Braun, 1963.

Bucculatrix demaryella (Duponchel) (Plates 1 (14–15), 4 (1–13). Figs 7A–C, 11F)
(Japanese name “Kuri-Chibiga”)

Elachista demaryella Duponchel, 1840: 547, pl. 309 fig. 5.

Bucculatrix demaryella: Seksjaeva, 1981: 136–148; Seksjaeva, 1989a: 194, 196, fig. 140-3; Arita *et al.*, 2009: 53, Pl.2, fig. 12.

Bucculatrix demaryella var. *castaneae* Kilmesch, 1950: 52.

Diagnosis. Forewing creamy white, mixed with brown. Male genitalia with valva broad toward apex, weakly divided into two lobes near apex; vinculum trapezoid. Female genitalia with lamella antevaginalis developed, fan-shaped.

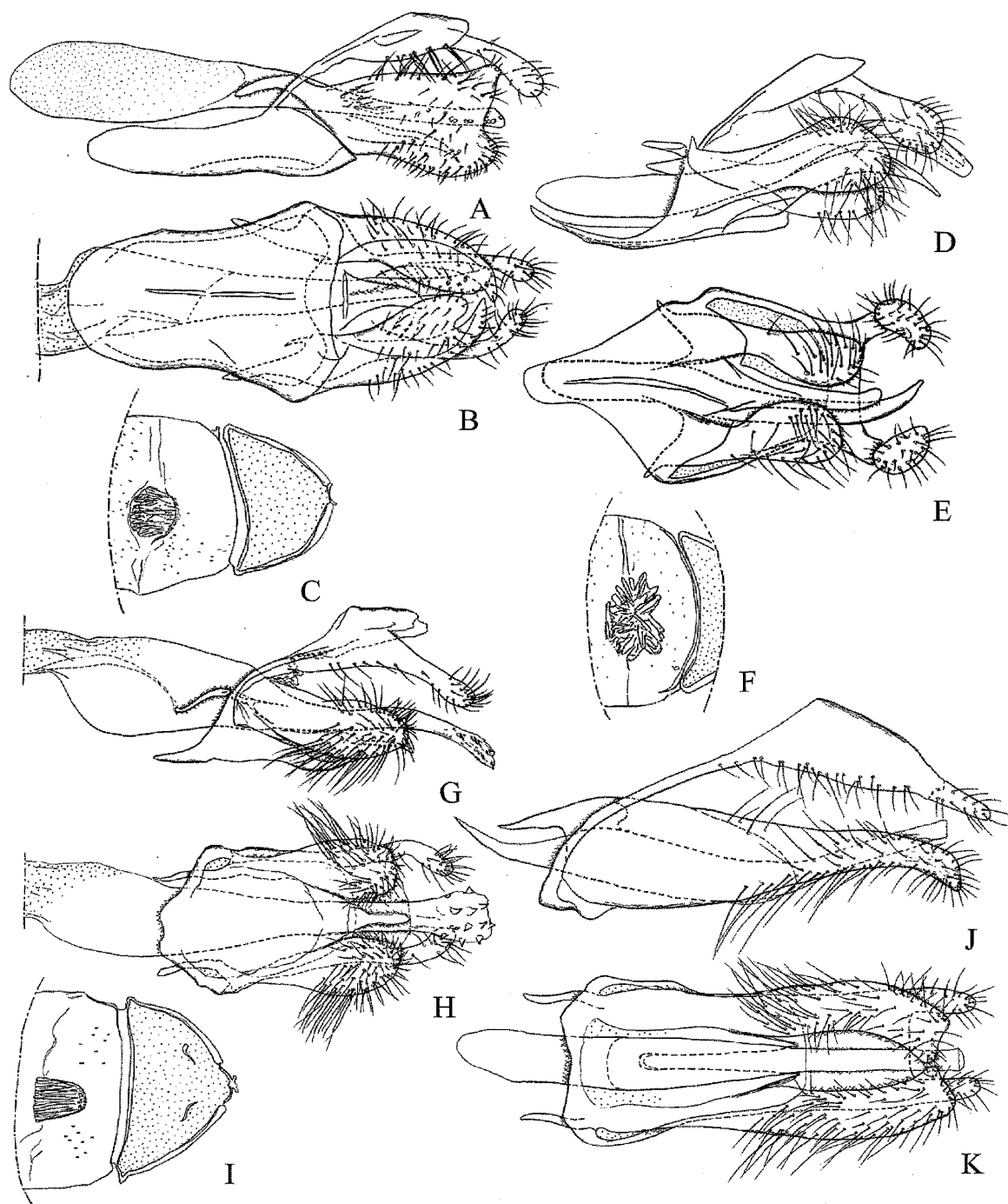


Fig. 7. Male genitalia and abdominal scale sac of *Bucculatrix* spp. A–C. *B. demaryella*. D–F. *B. serratella* sp. nov. G–I. *B. kogii* sp. nov. J–K. *B. thoracella*. A, D, G, J: Whole genitalia, lateral view. B, E, H, K: *Ditto*, ventral view. C, F, I: Scale sac, dorsal view.

Description. Wing expanse 6.0–7.5 mm. Frons ochereous-white; vertex tuft ochereous-white, slightly mixed with ochereous scales centrally. Eye-caps ochereous-white mixed with some pale brown and blackish scales. Antennae pale brown ringed with fuscous to black. Thorax ochereous-white, slightly mixed with blackish ochereous scales. Abdomen ochereous-gray. Anal tuft ochereous-gray. Scale sac small.

Forewings brownish-white; ochereous-brown obscure patches are found as follows; one from

fold to costa at 1/2, second from costa at 2/3 to apex and termen, three small ones from dorsum at 1/2 with some dark irrorations; some blackish irrorations and scales on termen; cilia ocherous-white. Hindwings gray; cilia whitish gray.

Male genitalia (Figs 7A–C). Socius long, slender, rounded at apex. Valva broad towards apex, divided into 2 lobes near apex. Aedeagus elongate with a few minute cornuti from apex to middle length of aedeagus. Juxta short, very slender, curved ahead, tapering to narrow apex. Vinculum trapezoid.

Female genitalia (Fig. 11F). Venter of segment 8 strongly sclerotized with numerous wrinkles. Lamella antevaginalis fan shaped, sclerotized, invaginated in middle at apex, with some radiating cancellous wrinkles. Ostium bursae circular, opening into parallel-sided depression, both sides with short two lobes covered with minute acute processes. Antrum cylindrical, joint-like over half length of antrum. Ductus bursae short, very slender. Corpus bursae globular; signum forming ring, spines acute.

Distribution. Hokkaido, Honshu (Tochigi, Nagano, Aichi, Nara, and Osaka Prefs.); West Europe, Russia (Seksjaeva, 1989ab).

Host plant. *Castanea crenata* Sieb. et Zucc. (Japanese name: Kuri), Fagaceae. *Betula platyphylla* var. *japonica* (Miq) Hara. (Japanese name: Shirakannba), Betulaceae.

Material examined—14 (11 ♂ 3 ♀)

Hokkaido: 1 ♂ 1 ♀, Mitsumata, Tokachi, 20–22, 25. viii. 2008 em. (S. Kobayashi & T. Hirowatari), Host: *Betula platyphylla* var. *japonica*, 5. viii. 2008 (larva); 1 ♂, Horoman, Samani, 12. vi. 2004. Nagano Pref.: [N. Hirano leg. Host: *Betula platyphylla* var. *japonica*]: 1 ♂, Ogura, Misato, 1. v. 1996 em. 14. x. 1995 (larva); 1 ♂, Karasawa, Yamagata Vil., 9. v. 1993 em. 4. x. 1992 (larva); 1 ♀, same locality, 3. v. 1996 em. 15. x. 1995 (larva); 1 ♀, Oyoriai, Nagawa, Matsumoto City, 19–20. x. 2008 em. (S. Kobayashi, T. Hirowatari), Host: *Castanea crenata*, 1. x. 2008 (larva); 1 ♂, Minodo, Chino, 15. viii. 2002. (H. Kuroko, T. Hirowatari, N. H. Ahn & B. W. Lee); 1 ♂, Asahi-dake, 22. vii. 2007 (T. Mano); Aichi Pref.: 3 ♂ Uradani, Shitara-cho, 28. v. 2006 (T. Hirowatari & B. W. Lee); Osaka Pref.: 1 ♂, Mt. Mikusa, Nose, 15–17, 22. ix. 2007 em. (T. Hirowatari), Host: *Castanea crenata* 29. viii. 2007 (larva); 1 ♂, same locality, 15. v. 2007 (S. Kobayashi & T. Hirowatari), adult on *Quercus serrata*; 1 ♂, same locality, 15. v. 2007. (S. Kobayashi & T. Hirowatari). Nara Pref.: 1 ♂, Wasamata, Kamikitaya, 23. v. 2006 (T. Hirowatari & B. W. Lee).

[Host: *Castanea crenata*]: Leaf mine: Mt. Izumi-Katsuragi, Osaka, 31. vii. 2007. (S. Kobayashi & T. Hirowatari). Larvae and cocoon: 1 ex, Shioi, Soni, Uda, Nara, 5. v. 2007 (S. & T. Kobayashi); Imai, Soni, Uda, Nara, 12. vii. 2008 (S. Kobayashi); 1 ex, same locality, 20. ix. 2008 (S. Kobayashi). [Host: *Betula platyphylla* var. *japonica*]: 1 ex, Kasaga-dake, Takayama, Nagano, 12–13. ix. 2009 (S. Kobayashi & H. Tsuruta).

Biology. The young larva is a leaf miner, forming a short serpentine mine on *Castanea crenata*; the mines are dark brown, about 5–10 mm in length, and 1–5 mines were usually observed in a leaf. The penultimate and final instar larvae are pale green (sometimes darker); the final instar larva is about 6.0–6.2 mm in length. The 1st and 2nd cocoonets were found on the upper or lower surface of the leaf, thin, flat and coloured white; the 1st, about 1 mm, and 2nd about 2–3 mm in diameter. The final instar larva spins a cocoon, usually on the lower surface of the leaf along the vein. The cocoon is ocherous-white to orange in coloration, (ca 5.0–6.0 mm in length, 1 mm in width).

In Hokkaido, larvae were collected from *Betula platyphylla* var. *japonica* early in August.

The biology is similar to that of the larvae on *Castanea crenata*. The leaf mine is of the short serpentine type, dark brown, about 6.0–7.0 mm in length, and 1–6 mines were usually observed on a leaf. Later and final instar larvae are pale green (sometimes darker), later 3.2 mm, final 5.5–6.0 mm in length. The 1st and 2nd cocoonets were found on the upper or lower surface of the leaf, thin, flattened and white in colour; 1st, about 1.5–2.0 mm, 2nd about 3.0–4.0 mm in length. Cocoons were found on the lower surface of the leaf along the vein, and were yellowish-white in coloration, (ca. 6.0–7.0 mm in length, 1 mm in width).

Remarks. The genital structure of this species is similar to that of some species (e.g. *B. ulmifoliae* Hering, 1931) in Section IV of Braun (1963). But this species is distinguished by the broad valva and aedeagus with minute cornuti from the apex to the middle length. This species is recorded from Western Europe (Seksjaeva, 1989a), and also Southern Maritime Territory in Russia (Seksjaeva, 1989b). Aceraceae (*Acer* sp., “Maple”), Betulaceae (*Betula* sp., *B. pendula*, *B. pubescens*, *Corylus* sp., *C. avellane*), and Fagaceae (*Castanea sativa*) are recorded in Europe as host plants of this species (Seksjaeva, 1989a; Claridge & Wilson, 1982 etc). In this study, we found that the genital structure of this species in both sexes is hardly distinguishable between those on *Betula platyphylla* var. *japonica* and those on *Castanea crenata*.

In this study, the leaf mine and cocoonet of this species were easily collected in summer in Nara and Osaka Prefs., but the larvae and cocoon were rarely collected. The leaf mine was rarely observed on planted chestnut trees in Nara Pref.

***Bucculatrix serratella* sp. nov.** (Plates 1 (16), 4 (14–22). Figs 7D–F, 12A)
(Japanese name “Keyaki-Chibiga”)

Bucculatrix sp. 1: Owada *et al.*, 2006: 47, fig. 43.

Diagnosis. Forewing ochreous-white. Male genitalia with valva rounded at apex; aedeagus short tapering to sharp apex; juxta slender, tapering to apex. Female genitalia with venter of segment 8 strongly sclerotized, with a median longitudinal sulcus anteriorly and wavy wrinkles posteriorly.

Description. Wing expanse 5 mm in holotype, 5.0–6.0 mm in paratypes. Frons ochreous-white; vertex tuft white, mixed with ochreous scales centrally. Eye-caps white sprinkled with ochreous scales. Antennae ochreous ringed with fuscous to black. Thorax ochreous white, with a pair of black dots towards the posterior. Abdomen pale gray. Anal tuft ochreous gray. Scale sac in middle.

Forewings ochreous-white, obscure brownish ochreous patches are found as follows; one narrow one from fold to middle at 1/2, a second from costa at 1/2, three from dorsum at 2/3 with a black plical dot and some dark irrorations; some blackish irrorations and scales on termen and apex. Cilia ochreous-white. Hindwings gray; cilia whitish gray.

Male genitalia (Figs 7D–F). Socius slender at base, rounded at apex, closed with fine hairs. Valva rounded at apex, median part slender, clothed with long curved hairs on inner and outer surface. Juxta slender, curved towards ventral side, tapering to the acute apex, half the length of the aedeagus. Vinculum rounded, nearly triangular. Aedeagus short, curved towards ventral side, sharp, tapering to the acute apex.

Female genitalia (Fig. 12A). Segment 9 elongate. Venter of segment 8 strongly sclerotized, posterior part with wavy wrinkles, anterior part with a median longitudinal sulcus and numerous lateral wrinkles. Ostium bursae subglobular, opening into a parallel-sided depression. Ductus bursae short, narrow near ostium bursae, widening towards posterior margin of

corpus bursae. Corpus bursae cylindrical; signum forming ring, spines acicular.

Distribution. Honshu: Tokyo (Owada *et al.*, 2006), Nagano, Aichi, Mie, Nara and Osaka Prefs.

Host plant. *Zelkova serrata* (Thunb.) Makino (Japanese name: Keyaki), Ulmaceae.

Material examined—8 (5 ♂♂, 3 ♀♀)

Type Material. HOLOTYPE ♂, JAPAN: Honshu, Nabari Central Park, Natsumi, Nabari, Mie Pref., 24. vii. 2008 em. Host: *Zelkova serrata* 5. vii. 2008 (larva), S. Kobayashi (genitalia slide no. OPU-SK084) in OPU. PARATYPES: 4 ♂♂, 3 ♀♀, same host plant as holotype. Nagano Pref.: [N. Hirano leg.]: 3 ♂♂, Nimura, Matsumoto, 25-30. vii. 1982 em. 21. vii. 1982 (pupa); 1 ♀, Inekoki, Azumi, 20. v. 1991. 8. ix. 1990 (larva); Osaka Pref.: 1 ♀, Osaka, Pref. Univ., Sakai, 20. vii. 2007 em. (S. Kobayashi), 17. vii. 2007 (cocoon); 1 ♀, same locality, 15-17. ix. 2007 em. (T. Hirowatari), 4. ix. 2007 (larva); 1 ♂, same locality, 5. x. 2007 (S. Kobayashi), adult on *Zelkova serrata*.

Leaf mine & Cocoonet: Aichi Pref.: Shidara, Kitashidara, 30. ix. 2008 (S. Kobayashi, T. Hirowatari, K. Ikeuchi); Leaf mine, Cocoonet, Cocoon: Mie Pref.: Natsumi, Nabari, 24. xi. 2007 (S. & T. Kobayashi); Nara Pref.: Imai, Soni, Uda, 31. viii., 7, 12. ix. 2008 (S. & T. Kobayashi).

Etymology. The specific epithet, *serratella*, derives from the species name of the host plant, *Zelkova serrata*.

Biology. The young larva is a leaf miner, forming slender, (often L-shaped) linear mines, dark brown, ca. 10-13 mm in length; 1-3 mines are usually observed in a leaf. The penultimate and final instar larva are pale green (sometimes darker) and about 4.0-5.2 mm in length. The 1st and 2nd cocoonets are on the surface of the leaf, thin, flattened and coloured white, about 2.0 mm (1st), and 3.0 mm (2nd) in diameter. Final instar larva spin a cocoon on the surface of the leaf along a vein or on the leaf stalk. The cocoon is whitish to ochreous in coloration about 4.0-5.0 mm in length, 0.8-1 mm in width.

Remarks: The genital structure of this new species is similar to that of some species (e.g. *B. appilicita* Seksjaeva, 1989) in Section VI of Braun (1963). But this species is distinguished by the rounded vinculum and valva. In Tokyo, in the garden of the Imperial Palace, Owada *et al.* (2006) collected cocoons on leaves and leaves of *Zelkova serrata* damaged by feeding and recorded the species as *B. sp. 1*, “Keyaki-Chibiga”. The male genitalia of the latter was not examined: we regard “Keyaki-Chibiga” as conspecific with *B. serratella* sp. nov.

In this study, we collected this species on boulevard trees in urban green areas (e.g. Osaka Pref. Univ., Nabari Central Park in Mie Pref.) and groves of a village shrines (e.g. “Kadofusa” Shito shrine in Nara Pref.). We collected and reared about one hundred cocoons and larvae in summer at Osaka Pref. Univ., but obtained only two emerged adults. This is attributable to a high rate of parasitism by undetermined chalcidoid wasps.

***Bucculatrix kogii* sp. nov.** (Plate 1(17). Fig. 7G-I.)
(Japanese name “Kogi-Chibiga”)

Diagnosis. Forewing white, mixed with black to brown. Male genitalia with valva rounded at apex; aedeagus broadened towards base; vesica broadened with numerous short heavy cornuti.

Description. Wing expanse 7.5 mm in holotype, 7.0-8.0 mm in paratypes. Frons pale lus-

trous ochereous white; vertex tuft creamy white, mixed with ochereous to brown scales centrally. Eye-caps creamy white sprinkled with ochereous scales. Antennae golden ochereous ringed with fuscous to dark brown. Thorax creamy white, scattered with dark brown scales. Abdomen fuscous to ochereous gray. Anal tuft pale ochereous. Scale sac in middle.

Forewing white, with a few dark brown irrorations; one obscure dark brown streak or patch from costa at 2/3 to dorsal area, another from dorsum at 1/2 to termen; one obscure dark brown streak from base to 1/3, another from dorsum at 1/3 to middle at 1/2; one black plical dot on dorsum at 1/2, another on costa at 2/3 to dorsal area and apical area; cilia ochereous, blackish ochereous toward apex. Hindwing gray; cilia pale gray.

Male genitalia (Figs 7G–I). Socius slender, curved and rounded at apex. Valva rounded at apex, weakly constricted medially. Juxta rounded to base, tapering from a point at 3/4 of the length of the aedeagus to apex. Aedeagus broadened towards base; vesica broadened with numerous short heavy cornuti.

Distribution. Hokkaido.

Host plant. Unknown.

Material examined—4 (4 ♂)

Type Material. HOLOTYPE ♂, JAPAN: Hokkaido, 1 ♂, Fukuyama, Hobetsu, 28. vi. 2008. (H. Kogi). Genitalia slide No. SK091. Hokkaido: [H. Kogi leg.]: PARATYPES: 1 ♂ Takaoka, 18. vi. 1993; 1 ♂, Komahata, Chitose, 23. vi. 2000; 1 ♂, Shinkai, Ishikari, 8. vi. 2002; 1 ♂, Ishikari-coast, Ishikari, 17. vi. 2007.

Etymology. The specific epithet, *kogii*, is dedicated to Mr Hiroyuki Kogi, who collected the holotype and paratypes and donated them to us.

Biology. Unknown.

Remarks. The genital structure of this species is similar to that of *B. serratella* sp. nov., but it is distinguished by the broadened vesica with numerous cornuti.

Group 9

Group 9 includes three species, (i) *B. thoracella* (Thunberg, 1794) (Host: *Tilia japonica* (Miq.) Simonk., Tiliaceae); (ii) *B. muraseae* sp. nov. (Host: *Alnus japonica* (Thunb.) Steud., Betulaceae); (iii) *B. cidarella* (Zeller, 1839) (Host: Unknown). These species are included in the *B. cidarella* group of Baryshnikova (2008) which includes five morphologically highly specialized and closely related species: (i) *B. cidarella* (Zeller, 1839); (ii) *B. bifida* Seksjaeva, 1989; (iii) *B. locuples* Meyrick, 1919; (iv) *B. similis* Baryshnikova, 2005; (v) *B. parasimilis* Baryshnikova, 2005. *B. thoracella* was assigned to the *B. ulmella* group of Baryshnikova (2008), but judging from the shape of the valva and absence of a scale sac, we group *B. thoracella* with the *B. cidarella* group of Baryshnikova (2008). In the male genitalia, the valva is elongate and stick-like in shape. In the female genitalia, the antrum is slender, attaching at the middle of the invagination of the ostium bursae.

Bucculatrix thoracella (Thunberg) (Plates 1 (18–19), 4 (23–30). Figs 1B, 7J–K, 12B)
(Japanese name “Yamabuki-Tora-Chibiga”)

Tinea thoracella Thunberg, 1794: 88.

Bucculatrix thoracella: Seksjaeva, 1989a: 193, 196, fig. 140–3.

Diagnosis. Forewing light orange brown, with black median fascia. Male genitalia with valva elongate, rectangular in ventral view. Female genitalia with lamella antevaginalis a slender lobe and numerous short lobes at both sides of ostium bursae.

Description. Wing expanse 6.0–7.5 mm. Frons lustrous pale ochereous white mixed with golden brown; vertex tuft light orange brown. Eye-caps pale creamy light brown. Antennae dark to ochereous ringed with fuscous to bronzy black. Thorax black or light brown beneath, partly scattered with black scales. Abdomen bronzy-gray. Anal tuft pale fuscous brown. Scale sac absent.

Forewing light orange brown, with a few dark fuscous irrorations; one broad straight or slightly curved black fascia at 1/4; one triangular black spot from costa at 2/3 to middle, another from dorsum at 1/2 to middle; one straight slender black line from middle at 1/2 to termen; one small black patch on base; cilia dark ochereous, blackish brown towards apex. Hindwing dark gray; cilia pale gray.

Specimens from Hokkaido have forewing light to brown, with a few dark fuscous irrorations; one black patch or plical dots from costa at 2/3 to middle, another from dorsum at 1/2 to middle; one black plical dot near dorsum at 1/2; one obscure white spot on costa at 1/2, another on dorsum at 2/5; cilia ochereous. Hindwing gray; cilia pale gray.

Male genitalia (Figs 7J–K). Socius slender with concave lobes, clothed with fine hairs. Valva elongate, rectangular in ventral view, curved centrally at apex, with long hairs in middle; basal part with anteriorly extending apophysis. Juxta sclerotized, half the length of the aedeagus. Vinculum very narrow, produced anteriorly into an acute angle. Aedeagus slender.

Female genitalia (Fig. 12B). Papillae anales slender with long thin apophyses anteriores. Lamella antevaginalis weakly sclerotized with a slender lobe and numerous short lobes located at both side of ostium bursae. Ostium bursae slender. Antrum tubular. Ductus bursae short. Corpus bursae globular; signum with the ribs strongly sclerotized, spines acute.

Distribution. Hokkaido, Honshu (Nara Pref.); Europe (Seksjaeva, 1989a).

Host plant. *Tilia japonica* (Miq.) Simonk. (Japanese name: Shinanoki), Tiliaceae.

Material examined—36 (16 ♂ 20 ♀)

Hokkaido: [H. Kogi leg.]: 1 ♀, Kotan, Atsuta, 9. viii. 2002; 1 ♂, Shiratsukari, Atsuta, 11. v. 2002 em. Host: *Tilia japonica*; 1 ♀, Same locality, 3. vii. 2006; 1 ♂, Oyafuru, Ishikari, 10. vi. 2001; 1 ♀, Same locality, 18. vi. 2002; [Shibi, Ishikari]: 1 ♂, 19. vi. 2006; 1 2 ♀, 18. ii. 2008 em. Host: *Tilia japonica*; 2 ♀ 2 ♀, 9–16. iii. 2008 em. Host: *Tilia japonica*; 5 ♂ 5 ♀, Shink, Ishikari, 14. vi. 2004; 3 ♀ 4 ♀, Shiomi, Mukawa, 17. iii. 2008 em. Host: *Tilia japonica*; Nara Pref.: 2, Odaigahara, Kamikitayama, Yoshino, 17, 27. vi. 2006 (L.T.) (T. Hirowatari, B. W. Lee, N. Yamamoto, A. Nobuoka, K. Yamada & A. Ito); 2 ♂, Odaigahara, Kamikitayama, Yoshino, 23. vi. 2009 (L.T.) (T. Hirowatari, S. Kobayashi, T. Yoshida, A. Inotsuka, K. Akita, and K. Ikeuchi).

Larvae: 50 exs, Shibi, Ishikari, Hokkaido, 7. viii. 2008 (S. Kobayashi, T. Hirowatari & H. Kogi).

Biology. This species has two generations in a year in Hokkaido. The larvae of August overwinter in the pupal stages. The young larva is a leaf miner, forming a short serpentine mine (ca. 10 mm in length); about 10–30 mines are usually found on a leaf. The penultimate instar larva is pale cream yellow (ca. 3.0–4.0 mm in length) and the final instar is pale yellow-

ish green in coloration (ca. 5.5–7.0 mm in length). The 1st and 2nd cocoonets are on the lower surface of the leaf, very thin, flattened and white or pale yellowish white in coloration, about 1.0–2.0 mm (1st), 3.0–4.0 mm (2nd) in diameter. The final instar larva spins an elongate cocoon (approximately ellipsoid in shape). The cocoon is pale orange in coloration (ca. 6.0 mm in length, 1 mm in width). Kogi (pers. comm.) observed the biology of this species in Hokkaido. The larvae were usually observed on the lower surface of the leaf. In this study, this species attained high population levels in early August in Hokkaido.

Remarks. The genital structure of this species is similar to that of *B. similis* Baryshnikova, 2005 in the *B. cidarella* group of Baryshnikova (2008). But this species is distinguished by the absence of a scale sac. The forewing coloration and patch pattern of adults in Hokkaido were different from those in Odaigahara, Nara Pref.. The coloration and patch pattern of adults in Odaigahara are more similar to those of adults in Europe than those in Hokkaido.

Larvae of this species mine leaves of maple, chestnut, beech, linden (e.g. *T. cordata* in Britain (Claridge & Wilson, 1982)) in Europe (Seksjaeva, 1989a). The hostplant of this species (*T. japonica*) is distributed from Hokkaido to Kyushu in Japan. Kogi confirmed that this species feeds on *T. japonica* in Hokkaido; however, no Bucculatricid mines were found on the plant in Odaigahara.

***Bucculatrix muraseae* sp. nov.** (Plates 1(20), 5(1–6). Figs 8A–B, 12C)

(Japanese name “Hannoki-Chibiga”)

Diagnosis. Vertex tuft white. Forewing white with three light brown oblique streaks. Thorax white with a pair of black dots. Male genitalia with socius oblong, with concave lobes. Female antrum flat and sclerotized.

Description. Wing expanse 6–8 mm. Frons pale white; vertex tuft white, mixed with a few blackish scales at apex. Eye-caps white. Antennae ochereous ringed with fuscous to black. Thorax white, with a pair of black dots. Abdomen ochereous gray. Anal tuft ochereous gray.

Forewings white, with light brown oblique streaks as follows: first narrow, from fold to base at 1/3, second slender, from costa at 1/2, following three slender from costa at 3/4; one light brown patch from dorsum to 1/2, a second very obscure, in dorsal area; black plical dot at middle termen; cilia white, fuscous brown towards apex. Hindwings gray; cilia whitish gray.

Male genitalia (Figs 8A–B). Socius oblong, with concave lobes. Valva elongate, spatulate, median setae very long, apical short. Aedeagus tapering to the narrow acute tip. Juxta elongate, slender, tapering to apex, half the length of the aedeagus. Vinculum sclerotized, produced anteriorly into an acute angle. Scale sac absent.

Female genitalia (Fig. 12C). Ostium bursae a conical-shaped invagination. Antrum slender, flat and sclerotized, point of attachment at middle of invagination of ostium bursae. Ductus bursae slender and short. Corpus bursae globular; signum with ribs strongly sclerotized, spines acute.

Distribution. Hokkaido, Honshu (Nara, Osaka, Wakayama, Hyogo Prefs.)

Host plant. *Alnus japonica* (Thunb.) Steud. (Japanese name: Hannoki), Betulaceae.

Material examined—22 (8 ♂ 14 ♀)

Type Material. HOLOTYPE ♂, JAPAN: Honshu, Imai, Soni, Uda, Nara Pref., 26. vii. 2007 em. Host: *Alnus japonica* 22. vii. 2007 (Cocoon), S. & T. Kobayashi (genitalia slide no.

OPU-SK001) in OPU. PARATYPES: 7 ♂ 14 ♀, same host plant as holotype. Hokkaido: 1 ♀, Koshimizu, Miwa, 29. vii. 1989 (S. Kawahara). Nara Pref.: [S. & T. Kobayashi leg.]: 1 ♂ 1 ♀, Imai, Soni, Uda, 14–18. vii. 2007 em. 8. vii. 2007 (Cocoon); 1 ♂, same locality, 29. vii. 2007 em. 22. vii. 2007 (Cocoon). Osaka Pref.: 1 ♂ 1 ♀, Nariainishi, Kumatori, 10–11. viii. 2007em. (S. Kobayashi & T. Hirowatari), 31. vii. 2007 (Cocoon); 1 ♂ 7 ♀, same locality, 26. viii., 3–9. ix. 2007em. 21. viii. 2007(Cocoon); 1 ♂ 1 ♀, Kagata, Minami-Kawati, 29. iv. 1955 (S. Issiki), '54 examined, OPU; 1 ♀, Iwawaki-san, 13. vii. 1954 em. (S. Issiki), 29. vi. Examined. Additional material: Wakayama Pref.: [Okawachi, Wakayama, M. Murase leg.]: 1 ♂, 19. x. 2008 em., 27. ix. 2008 (larva); 1 ♂ 1 ♀, 12, 18. xi. 2008 em., 27. ix. 2008 (larva). Hyogo Pref.: 1ex, Shima, Inagawa, Hyogo, 15. v. 2007 (S. Kobayashi & T. Hirowatari), Adult on *Alnus japonica*.

Etymology. The specific epithet, *muraseae*, is dedicated to Ms. Masumi Murase, who provided valuable information on alder feeding Bucculatricid moths, and collected specimens of this species and donated them to us.

Biology. The young larva is a leaf miner, forming a slender, threadlike, blackish ocherous, linear mine; (ca. 20–26 mm. in length): 1–3 mines were usually observed in a leaf. The penultimate and final instar larva is dark pale green in coloration, about 4.0–5.0 mm in length. The 1st and 2nd cocoonets are on the lower surface of the leaf, papery in texture and bright yellow in coloration, about 2.0 mm in length (1st), and about 3.5–4.0 mm (2nd) in diameter. The cocoon is bright yellow in coloration, (ca. 6.5–7.0 mm in length, 0.8–1.0 mm in width).

Remarks. This new species is distinguishable from the closely allied species, *B. cidarella* (Zeller, 1839) and *B. bifida* Seksjaeva, 1989, by the slender socii tapering to apex without incurved apices in the male genitalia as well as by the external coloration: *B. cidarella* has black forewings and thorax, and different pattern and *B. bifida* has two white spots or a wide spot on forewing without streaks. Murase (pers. comm) collected and reared the larva in Wakayama Pref. This species has a characteristic coloration of cocoonet and cocoon.

The Menashi-jizo, Imai, Soni (elevation about 670 m; type locality of *B. muraseae* sp. nov.) is a small alder thicket (about 50 m × 50 m) within a planted forest of Japanese cedar and cypress. The type locality was flooded from June to August (about ~10–30 cm depth).

Bucculatrix cidarella (Zeller) (Plate 1 (21). Figs 8C–D, 12D)
(Japanese name “Shirahoshi-Chibiga”)

Lyonetia cidarella Zeller, 1839: *Isis*: 216.

Bucculatrix cidarella: Seksjaeva, 1989a: 193, 196, fig. 140–5.

Diagnosis. Forewing black with pale white spots. Male genitalia with socius oval, concave; aedeagus long, tapering to a sharp point. Female genitalia with ostium bursae a pouch-like invagination; dorsal margin of segment 7 with small petal-like scales.

Description.

Male (Figs 8C–D) and female genitalia (Fig. 12D): See Braun (1963) and Seksjaeva (1989a).

Distribution. Honshu (Nagano, Gifu Prefs.); Kazakhstan, Europe (Seksjaeva, 1989a).

Host plant. Unknown in Japan.

Material examined—5 (3 ♂ 2 ♀)

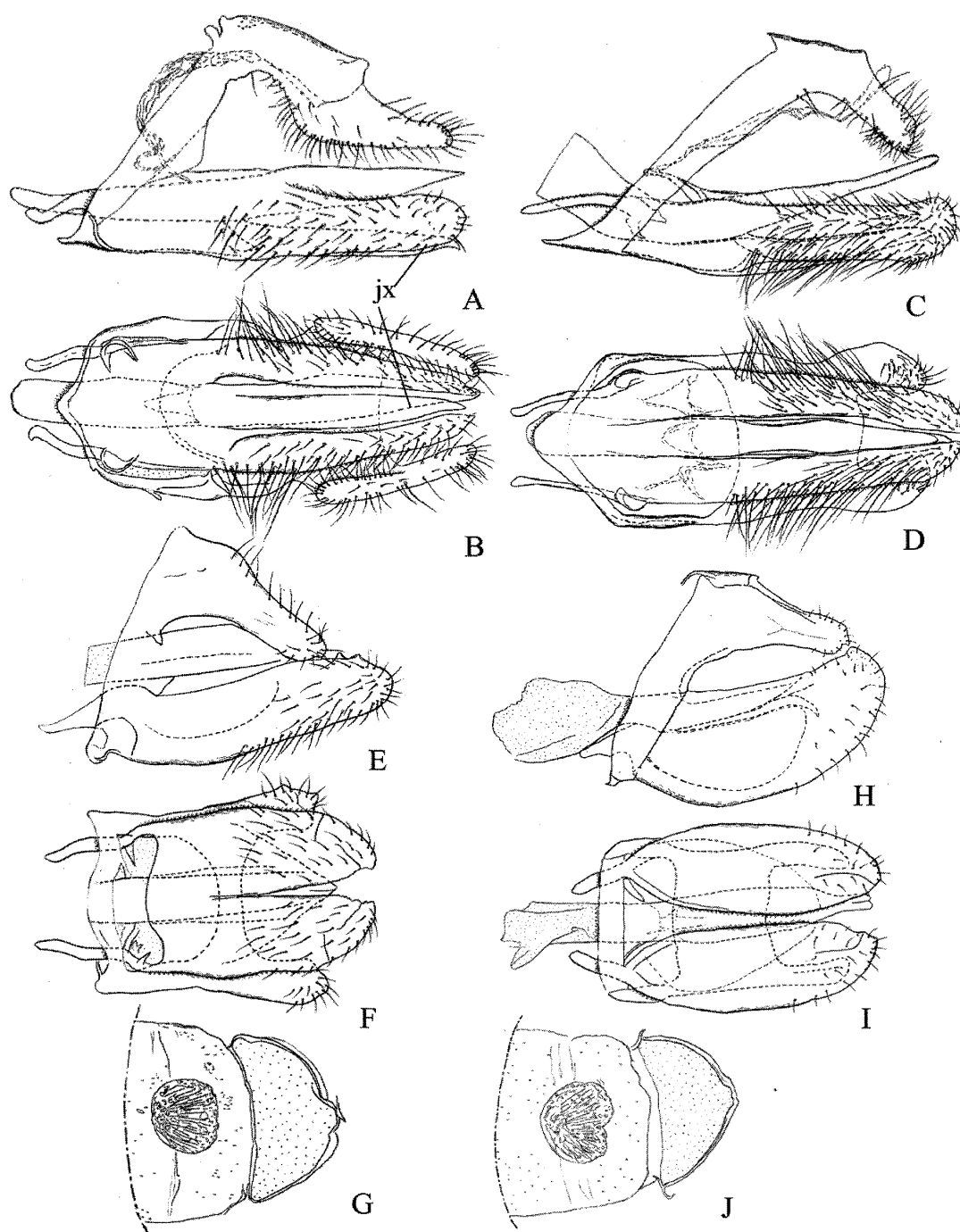


Fig. 8. Male genitalia and abdominal scale sac of *Bucculatrix* spp. A–B. *B. muraseae*. C–D. *B. cidarella*. E–G. *B. tsurubamella* sp. nov. H–J. *B. comporabile*. A, C, E, H: Whole genitalia, lateral view. B, D, F, I: *Ditto*, ventral view. G, J: Scale sac, dorsal view. jx: juxta.

Nagano Pref.: [N. Hirano leg.]; 2♂, Kisojihara, Nagawa, 24. vi. 1990; 1♀, same locality, 19. vi. 1999; 1♂, Shimashima-dani, Azumi, 19. viii. 1996; Gifu Pref.: 1♂, Abo-daira, Kamitakara, 29. vi. 2003.

Biology: Unknown.

Remarks. Larvae of this species mine leaves of alder in Europe (Seksjaeva, 1989a). The

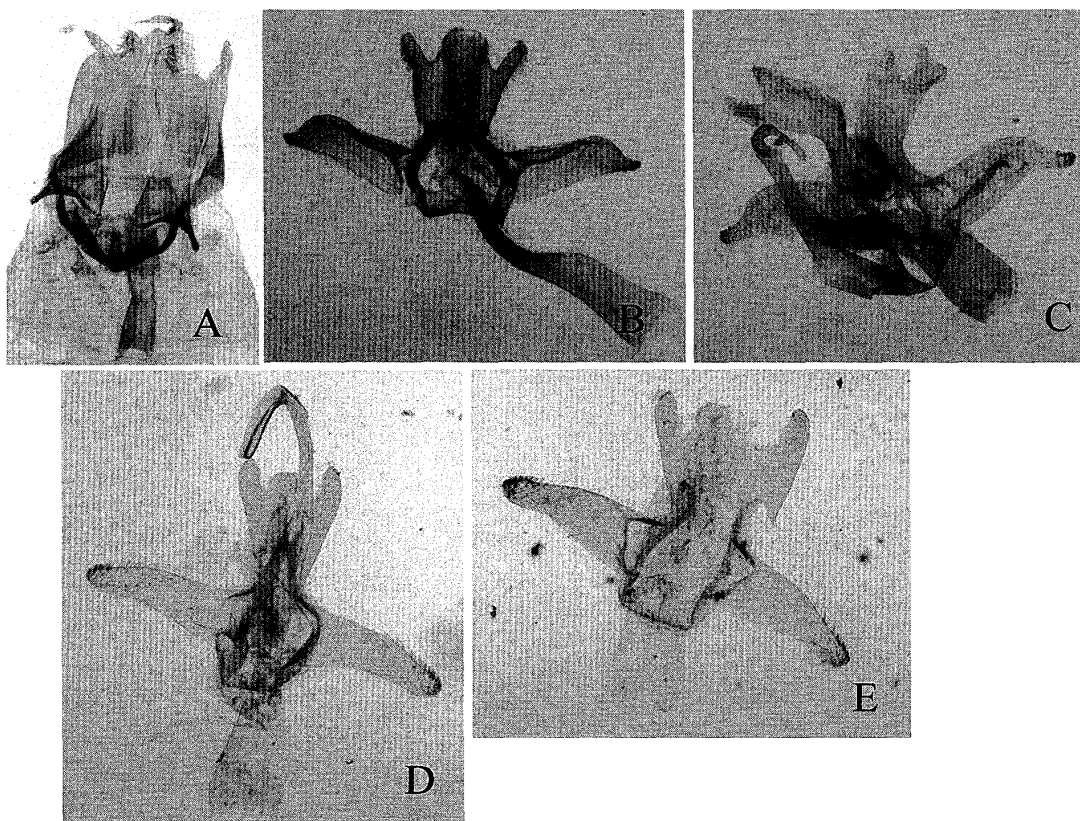


Fig. 9. Male genitalia of *Bucculatrix* spp. A. *B. maritima* (A: genital slide prepared by H. Kogi). B. *Bucculatrix* sp. 1 of Oku (2003) (= *B. nota*). C. *Bucculatrix* sp. 2 of Oku (2003). D. *Bucculatrix* sp. 3 of Oku (2003). E. *Bucculatrix* sp. 4 of Oku (2003) (= *B. splendida*). (B-E: genitalia slides prepared by T. Oku)

genital structure of this species in both sexes is very similar to that of the North American species *B. locuples* Meyrick, 1919, also an alder feeder in Sections IV of Braun (1963). Although the forewing markings of this species are the same in number as in *B. locuples* and similarly placed, *B. locuples* has markings with a brilliant golden luster (Braun, 1963). This species belongs to the *B. cidarella* species-group (e. g. *B. bifida* Seksjaeva, 1989, *B. similis* Baryshnikova, 2005, *B. parasimilis* Baryshnikova, 2005), a small group of morphologically highly specialized and closely related species (Baryshnikova, 2005).

Group 10

Group 10 includes two species, (i) *B. tsurubamella* sp. nov. (Host: *Quercus acutissima* Carruthers, Fagaceae); (ii) *B. composable* Seksjaeva 1989 (*Q. crispula* Blume, *Q. dentata* Thunb. and presumably, *Q. serrata* Thunb., Fagaceae). These species are included in *B. ulmella* group of Baryshnikova (2008). These species are very closely related to European *B. ulmella*. The genital structures are very simple type. In the male genitalia, the valva is small and rounded, the aedeagus is short, cylindrical, not specialized shaped. The female genitalia are characterized by the segment 8 being retracted into segment 7 and posterior half of the sternite 7 being sclerotized.

***Bucculatrix tsurubamella* sp. nov.** (Plates 1 (22), 5 (7–12). Figs 8E–G, 12E)

(Japanese name “Kunugi-Chibiga”)

Diagnosis. Vertex tuft ochereous-white, with light orange cluster of scales in center. Forewing white with orange-brown streaks. Male genitalia with short valva; valvae fused basally. Female genitalia with posterior margins of segment 7 fringed with long specialized scales dorsally; anterior apophyses claw-like, basally broad.

Description. Wing expanse 6.3 mm in holotype, 6.0–7.0 mm in paratypes. Frons lustrous ochereous-white; vertex tuft ochereous-white, with light orange-brown cluster of scales in center. Eye-caps white sprinkled with light orange-brown scales. Antennae pale ochereous ringed with brownish to black. Thorax creamy white, with two streaks of scattered light yellowish-brown scales with blackish scales at end of thorax. Abdomen ochereous-gray. Anal tuft ochereous-gray. Scale sac in middle.

Forewings white, with a few orange or light orange-brown oblique streaks as follows: one narrow one from costa 1/3 to middle at 1/2, a second broad one from costa at 3/4 to dorsal area. Light orange-brown patches are found as follows: one from base to 1/3, a second on dorsum at 1/3 with some dark irrorations; some dark brown irrorations and scales on termen and apex; cilia white. Hindwings gray; cilia whitish gray.

Male genitalia (Figs 8E–G). Socii very short, clothed with fine hairs directed outside at apex. Valva short with some weak processes near apex, fused basally, clothed with fine hairs. Aedeagus short, weakly sclerotized. Juxta indistinct. Vinculum slender.

Female genitalia (Fig. 12E). Posterior margins of segment 7 fringed with long specialized scales dorsally; small sinuate stripes anterior to ostium bursae. Anterior apophyses claw-like, basally broad, attached to antero-lateral angles of segment 7. Ostium bursae dish-like. Lamella antevaginalis short, spine-shaped. Ductus bursae broad, membranous, narrow near ostium bursae. Corpus bursae globular with signum ribs short, basally broad.

Distribution. Honshu (Nara and Osaka Prefs.)

Host plant. *Quercus acutissima* Carruthers (Japanese name: Kunugi), Fagaceae.

Material examined—7 (3 ♂ 4 ♀)

Type Material. HOLOTYPE ♂, JAPAN: Honshu, Konagao, Soni, Nara Pref., 12–14. x. 2008 em. Host: *Quercus acutissima*, 20. ix. 2008 (larva), S., Y. & M. Kobayashi (genitalia slide no. OPU-SK120) in OPU. PARATYPES: 2 ♂ 4 ♀, the same host plant as holotype. Osaka Pref.: 1 ♂, 4 ♀, Sakai, 7–8, 16–17. iv. 1955 em. (S. Issiki), xi. 1954; 1 ♂, Osaka, Pref. Univ. Sakai, 10. iv. 1967 em. (H. Kuroko), xi. 1966; 1 ♂, Mt. Mikusa, Nose, 28. ix. 2008 em. (A. Nobuoka, S. Kobayashi & T. Hirowatari), 27. viii. 2008 (larva).

Leaf mine & Cocoonet : Nara Pref.: Konagao, Soni, Uda, Nara, 29. x. 2007 (S. Kobayashi). **Cocoon** : 5 exs, same locality, 19. iv., 3, 13. v. 2007 (S. & T. Kobayashi).

Etymology. The specific epithet, *tsurubamella*, derives from another Japanese name “Tsurubami” of host plant, *Quercus acutissima*.

Biology. This species has a few generations a year in Nara Pref. The larvae emerged in late October in 2007 and early June to September in 2008 and 2009 in Nara Pref. Cocoons were collected on the trunk in the same locality in April and May. The young larva is a leaf miner, forming a slender linear (or sometimes serpentine) mine (ca. 10–15 mm in length), often J-shaped, along the midrib; 2–3 mines were usually observed on a leaf. The penulti-

mate and final instar larvae are olive to moss green (In Japanese, “Aoshiro-tsurubami”) in coloration about 5.0 mm in length. The 1st and 2nd cocoonets, on the surface of the leaf, are thin, flattened and colored white, about 1.8 mm (1st), and 3.0 mm (2nd) in diameter. The cocoon is ochreous-white in coloration about 5.0 mm in length, and 0.8 mm in width.

Remarks. This new species is closely related to *B. comporabile* Seksjaeva, 1989, but the latter has rounded valvae with the basal part unfused.

In the type locality of *B. tsurubamella*, *Q. acutissima* hostplant trees were planted within crofts and the village landscape area about 20 years ago and have been well managed (e.g. artificial pruning and clipping).

Bucculatrix comporabile Seksjaeva (Plates 1 (23, 24), 5 (13–21). Figs 8H–J, 12F)
(Japanese name “Konara-Chibiga”)

Bucculatrix comporabile Seksjaeva, 1989b: 621, fig. 2; Baryshnikova & Dubatolov, 2007: 47; Arita *et al.*, 2009: 53, Pl.2, fig. 11.

Diagnosis. Vertex tuft ochreous-white to brown with a brown cluster of scales in center. Forewing creamy white with brown patches. Male genitalia with short oval valvae not fused basally. Female genitalia with posterior margins of segment 7 fringed with long specialized scales dorsally; apophyses anteriores claw-like, basally broad.

Description. Wing expanse 6.0–7.0 mm. Frons ochreous-white; vertex tuft brown, mixed with some white scales. Eye-caps white with some light brown scales. Antennae pale brown ringed with fuscous to black. Thorax light brownish white. Abdomen bronzy gray. Anal tuft ochreous-gray.

Forewings brown, with brown patches as follows: one from base to 1/3, another broad one from costa at 2/3 to dorsal area; one black plical dots on dorsum at 1/2, another on costa at 2/3; cilia white or whitish ochreous toward apex. Hindwings gray; cilia whitish gray. Scale sac in middle.

Male genitalia (Figs 8H–J). Socii very short, slender. Valvae short, oval, separated basally. Aedeagus short, weakly sclerotized. Juxta slender, weakly sclerotized. Vinculum slender.

Female genitalia (Fig. 12F). Posterior margins of segment 7 fringed with long specialized scales dorsally and ventrally except around ostium bursae. Apophyses anteriores claw-like, basally broad, extending from antero-lateral angles of segment 8. Ostium bursae dish-like. Ductus bursae with anterior half sclerotized and rest membranous, broad near corpus bursae. Corpus bursae globular with signum ribs short, basally broad.

Distribution. Hokkaido, Honshu (Tochigi, Nagano, Osaka Prefs.); Europe; Russian Far East (Seksjaeva, 1989a).

Host plant. *Quercus crispula* Blume, *Quercus dentata* Thunb. (Japanese name: Mizunara, Kashiwa) and presumably, *Quercus serrata* Thunb. (Japanese name: Konara), Fagaceae.

Material examined—33 (17 ♂ 15 ♀, 1 ex)

Hokkaido: [H. Kogi leg.]: 2 ♂ 2 ♀, Otonrui, Horonobe, 18. vi. 2004; 1 ♀, Oyafuru, Ishikari, 17. v. 2001; 1 ♀, Same locality, 24. viii. 2002; 1 ♂, 1 ex, Shibi, Ishikari, 8. viii. 2008 em., Host: *Quercus crispula*, 4. viii. 2008 (cocoon); [Shinko, Ishikari]: 1 ♂, 14. vi. 1999; 1 ♂, 4. iii. 2005, Host: *Quercus crispula*. 1 ♀, 8. vi. 2002; 1 ♀, Komasato, Chitose, 26. v. 2002; 1 ♀, Same locality, 16. vi. 2002; 1 ♂, Shizukawa, Tomakomai, 16. v. 2002; 1 ♂, Zenibako, Otaru, 23. v. 2001; [Host: *Quercus dentata*]: 1 ♀, Kitaurimaku, Sikaoui, 13. viii. 2005 em.; 1 ♂ 2 ♀,

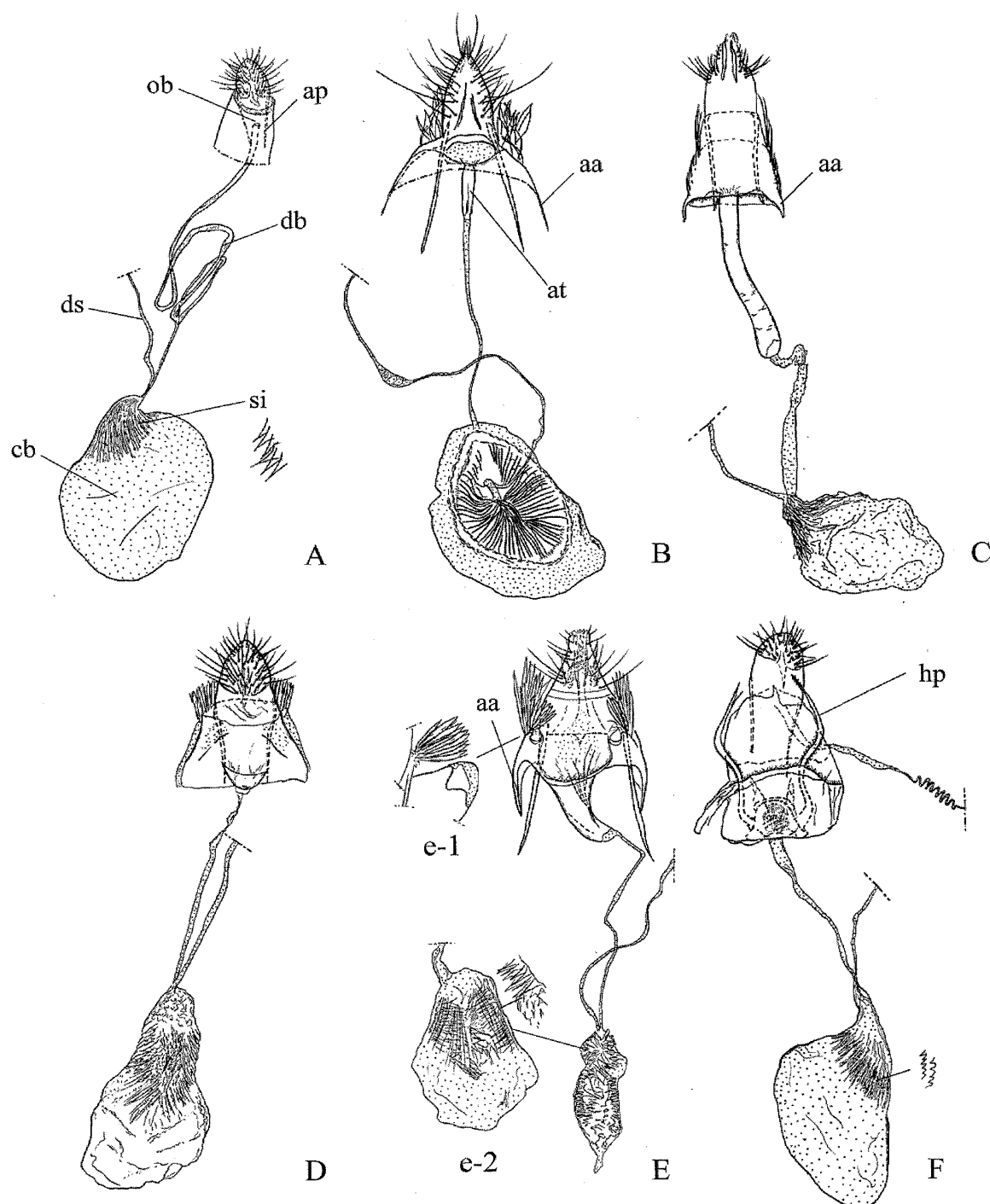


Fig. 10. Female genitalia of *Bucculatrix* spp. A. *B. firmanella*. B. *B. hamaboella*. C. *B. splendida*. D. *B. maritima*. E. *B. notella*. F. *B. sinevi*. A-F: Whole genitalia, ventral view. e-1 Lateral plate of segment 7, more highly magnified. aa: anterior apophyses; ob: ostium bursae; at: antrum; db: ductus bursae; ds: ductus seminalis; cb: corpus bursae; horn-shaped processes; si: signa.

Tomioka, Hayakita, 29-31. v. 2005 em.; 4♀, Shibi, Ishikari, 26-31. v. 2005 em.; 1♂, Tomikawa, Monbetsu, 24. v. 2006 em.; [Shiomi, Mukawa]: 1♀, 12. ii. 2005 em.; 4♂, 11-15. v. 2005 em.; 1♂, 16. viii. 2005 em.; 1♂, 12. viii. 2007 em.; Tochigi Pref.: 1♀,

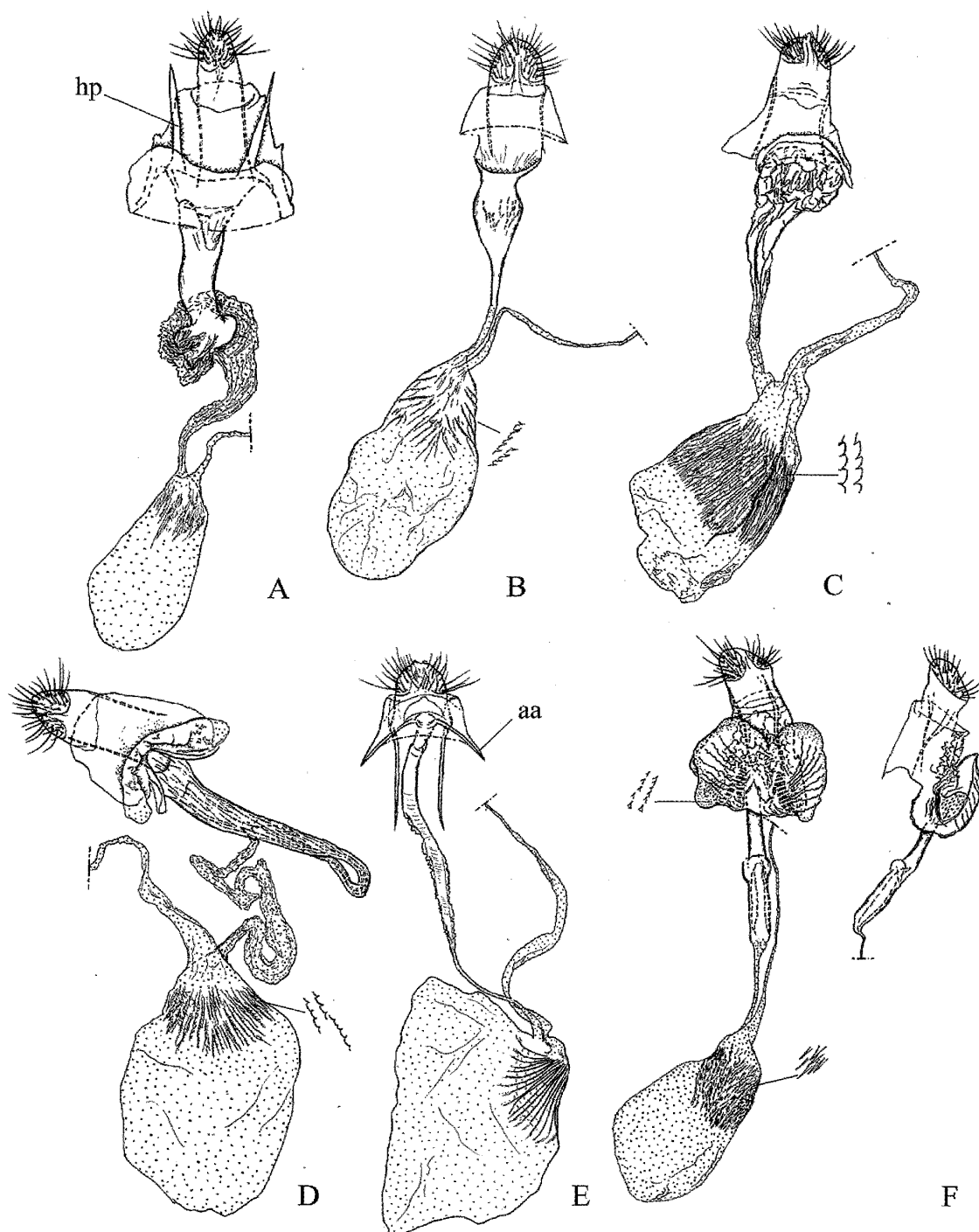


Fig. 11. Female genitalia of *Bucculatrix* spp. A. *B. altera*. B. *B. pyrivorella*. C. *B. citima*. D. *B. armata*. E. *B. univoca*. F. *B. demaryella*. A-F: whole genitalia, ventral view. aa: anterior apophyses; hp: horn-shaped processes.

Yumoto, Nasu, 8. x. 2007 em. (M. Murase). Cocoon on *Quercus serrata*. Nagano Pref.: 1 ♂, Okuchizawa, Toyoshina, 16. v. 1994 em. (N. Hirano), Cocoon on *Quercus serrata*. Osaka Pref.: 1 ♂, Mt. Mikusa, Nose, 17. iv. 2007 em. (S. Kobayashi & T. Hirowatari). Cocoon on *Quercus serrata*; 1 ♀, same locality, 18. iv. 2007 em. (S. Kobayashi & T. Hirowatari).

Cocoon on *Castanea crenata*; 1 ♀, Imakuma, Sayama, 28. v. 2007 (S. Kobayashi & D. Tanaka). Adult on *Quercus acutissima*.

Biology. Kogi (pers. comm.) collected and reared this species from *Quercus crispula* Blume and *Q. dentata* Thunb. This species has two generations a year in Hokkaido. The young larva is a leaf miner, forming a linear mine (ca. 10–20 mm in length); about 1–3 mines are usually found on a leaf. The penultimate instar larva is lustrous pale yellowish green (ca. 4.0–5.0 mm in length) and the final instar is lustrous olive green in coloration (ca. 5.0–7.0 mm in length). The 1st and 2nd cocoonets are very thin, flattened and white in coloration, 3.0 mm in diameter. The cocoon is white in coloration (ca. 6.0 mm in length, 1 mm in width).

Remarks. The genital structure of this species is similar to that of some species (e.g. *B. ulmella* Zeller, 1848) in the *B. ulmella* group of Baryshnikova (2003) and in Sections IV of Braun (1963). But this species is distinguished by the short oval valva. The European species, *B. ulmella* Zeller, 1848, feeding on Pinaceae (*Pinus sylvestris*), Rosaceae (*Sorbus* spp.), and Ulmaceae (*Ulmus* spp.), has a very similar genital structure to this species and *B. tsurubamella*.

The host range of the species includes a number of *Quercus* species. We did not succeed in collecting larvae of this species except for cocoonets collected from *Q. aliena* in summer. Thus, almost no larvae of Fagaceae-feeding species (e.g. *B. comporabile*, *B. tsurubamella*, *B. demaryella*) were collected from the hostplants.

The biology and larval habits of Japanese species

In the present study, 15 *Bucculatrix* species were reared, and the biology of seven species is described for the first time. Oku (2003) noted the biology of *B. nota* but we did not ourselves observe it. The 16 Japanese species may be grouped into three main types on the basis of larval habits, which is based on the two divisions of Braun (1963).

(1) The first type includes eleven species (*B. firminaella* and species from Groups 3 to 10). In this type, the larvae are leaf miners when very young (presumably 1st and 2nd instars), and in the later instars (presumably 3rd and 4th instars), feed exposed, and usually proceed to eat the epidermis of one side and some mesophyll, skeletonizing it. At the end of the 2nd and 3rd instars, the larva spins a cocoonet and molts within it. The final instar larva spins an elongate cocoon, usually on the lower surface of the leaf or on the leaf stalk (Figs 1–A, B).

(2) The second type includes four species: *B. splendida*, *B. maritima*, *B. notella*, and *B. nota* (Group 2). The young larva (presumably 1st and 2nd instars) is a leaf miner of *A. princeps*; the later instars enter the leaf through circular holes and mine out the leaf tissue or peel away and roll up the lower epidermis, and eat irregular patches of the leaf tissue, leaving the upper epidermis intact (Fig. 1–C). The larva, presumably 2nd instar only, spins a cocoonet. The larva of *B. maritima* has larval habits abnormal in Group 2. The young larva is similarly a leaf miner of *Aster tripolium*: however the later instars subsequently make one or more shorter mines or feed exposed, skeletonizing the leaf tissue.

(3) The third type includes one species, *B. hamaboella* (Group 1). The larva is a leaf miner in the early stage but in later instars becomes a stem borer, which is an unusual feeding habit in contrast to other species in the family (Fig. 1–D) (Kobayashi *et al.* 2009).

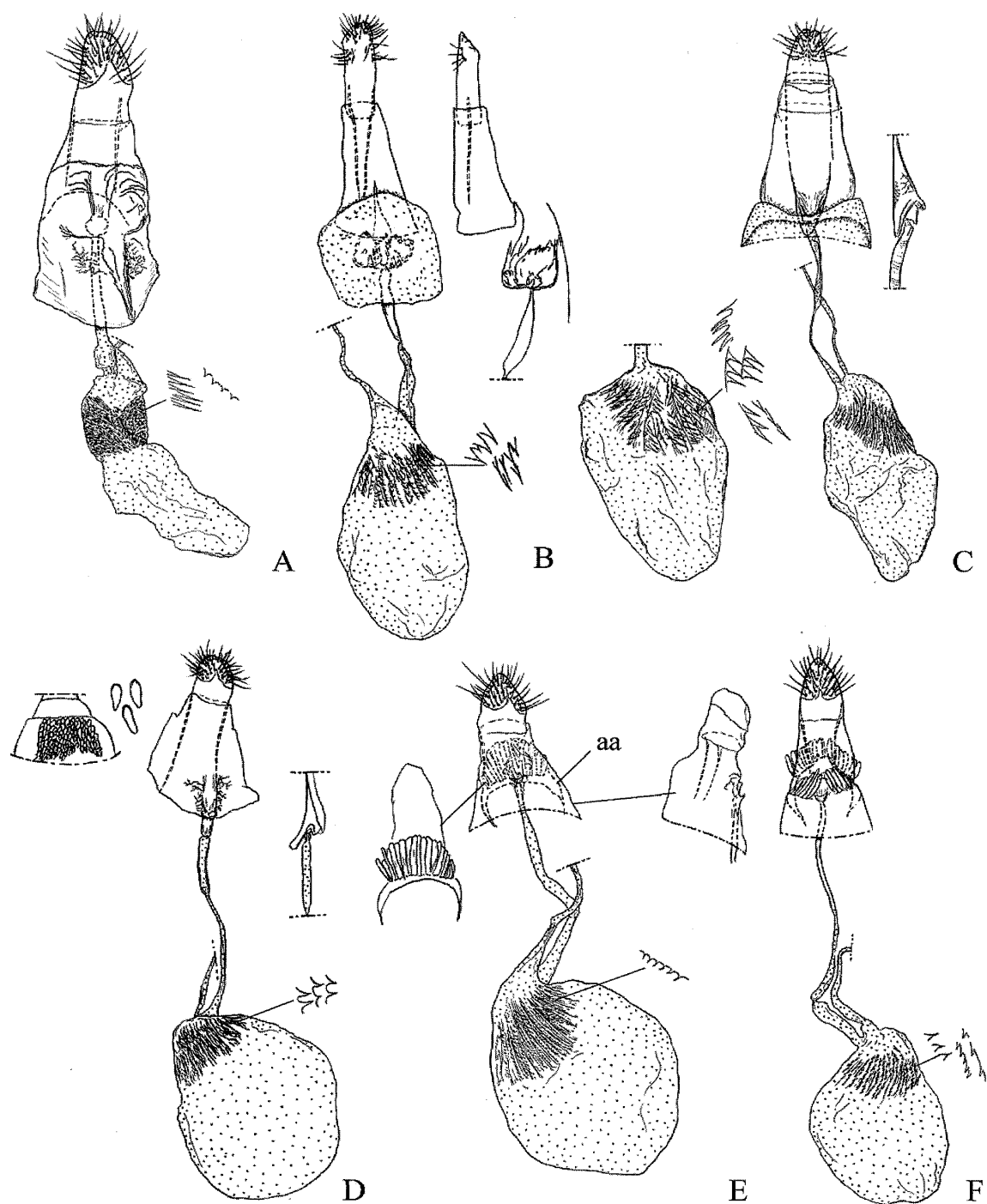


Fig. 12. Female genitalia of *Bucculatrix* spp. A. *B. serratella* sp. nov.. B. *B. thoracella*. C. *B. cidarella*. D. *B. muraseae* sp. nov.. E. *B. tsurubamella* sp. nov.. F. *B. comorabile*. A-F: whole genitalia, ventral view.

Discussion

Relationships between species groups and host plant families

In the present study, we include *B. firminaella* (host plant: *Firmiana simplex*, Sterculiaceae)

and *B. hamaboella* (host plant: *H. hamabo*, Malvaceae) in Group 1. Kuroko (1964) considered that *B. firminaella* belongs to an unknown section but may be an ancient species of Section VIII of Braun (1963), which includes Malvaceae feeding species. Since the host plant family of this species, Sterculiaceae, is taxonomically closely related to Malvaceae, this may be appropriate. However, the genitalia of both sexes of this species are very simple: the female genitalia of this species are rather similar to those of the species of Section I of Braun (1963), and the male genitalia (e.g. the long valva and socii and the narrow tegumen) are similar to those of *B. hamaboella* and some species of Section I and II of Braun (1963). In contrast, all the species of Section VIII have unusual and unique genitalia in both sexes. Thus, *B. hamaboella* (as pointed out by Kobayashi *et al.*, 2009) and *B. firminaella* might derive from Asteraceae feeders by host shift, or alternatively *B. firminaella* might be an ancient species belonging with taxa which diverged early on (e.g. the *albella* groups of Baryshnikova (2008)), but this needs further investigation.

Evolution of larval habits

Baryshnikova (2003; 2008) discussed the relationships between the Bucculatricid moths and their host plants on the basis of the obtained phylogenetic hypothesis. The genus *Bucculatrix* was split into five early divergent taxa (species groups: *magnella*, *gnaphaliella*, *lavaterella*, *albella*, *ceanothiella*), and one monophyletic clade (including 11 species groups) (Baryshnikova, 2008). In the Bucculatricidae, gall forming, stem boring and untypical types of larval habits are known in three early divergent taxa (species groups: *magnella*, *gnaphaliella*, *lavaterella*) of Baryshnikova (2008). The clade of 11 species groups of Baryshnikova (2008) almost all appear to have the first type larval habits of the present study.

Larvae of Japanese *Bucculatrix* species are leaf miners except *B. hamaboella*, whose later instar larva becomes a stem borer. The larval habits of 11 Japanese species are grouped into the first type. In the second type, including three *A. princeps* feeding species, *B. splendida*, *B. notella*, and *B. nota*, the young larvae are leaf miners, but in the later instars, they spin a cocoonet only once and enter circular holes or peel away the leaf tissues. In another species of the second type, the larva of *B. maritima* has two developmental phases: in the second phase it makes short mines or becomes an external feeder (Jansen & Hemminga, 1988). The species of the second type and Section II of Braun (1963) are included in the *B. gnaphaliella* group of Baryshnikova (2008). Some Asteraceous feeding species in Section II of Braun (1963) have larvae which mine throughout larval life, never feeding exposed. The larva of *B. angustata* forms several mines within a leaf (Braun, 1963).

According to the phylogenetic relationships of Bucculatricid species shown by Baryshnikova (2008), as a hypothesis for the evolution of Bucculatricid larval habits it might be guessed that the primitive larval habits were gall forming, stem boring and boring in woody or hard tissues (e. g. species groups: *magnella*, *lavaterella*), following which a second type was derived (entering circular holes or peeling away the leaf tissues) and making a cocoonet only once or in some cases mining throughout larval life, but never feeding exposed. Finally the first type diverged, in which the later instar larvae feed exposed, skeletonizing the leaf and making both first and second cocoonets.

However, as discussed by Kobayashi *et al.* (2009), the unique habits seen in a stem borer species *B. hamaboella*, where an external non-feeding larvae undergoes a double molt within one cocoonet, are considered to be an abbreviated form of the external feeding instars of the first type (ie making first and second cocoonets, and undergoing a single molt within each cocoonet). This might indicate that the stem boring habit of *B. hamaboella* is not prim-

Table 1. Check list of Japanese species of Bucculatricidae

Species name	Japanese name	Host plant	Distribution
1* <i>Buccularix firmianella</i> Kuroko, 1982	Aogiri-Chibiga	<i>Firmiana simplex</i> (Japanese name: Aogiri), Sterculiaceae	Honshu, Shikoku, Kyushu
2* <i>B. hamabolla</i> Kobayashi, Hirowatari & Kuroko, 2009	Hamabo-Chibiga	<i>Hibiscus hamabo</i> (Hamabo), Malvaceae	Honshu (Mie and Wakayama Prefs.)
3 <i>B. splendida</i> Seksjaeva, 1992	Haiiro-Chibiga	<i>Artemisia princeps</i> Pampan. (Yomogi), Asteraceae	Hokkaido (new record), Honshu: Iwate Pref., Nagano Pref. (new record); Russian Far East
4 <i>B. laciniatella</i> Benander, 1931	Azusagawa-Chibiga	Unknown in Japan	Honshu (Nagano Pref.); Europe
5 <i>B. sp. 1</i> (nr. <i>bicinica</i> Seksjaeva, 1992)	—	Unknown	Honshu (Iwate Pref.)
6 <i>B. maritima</i> Stainton, 1851	Uragiku-Chibiga	<i>Aster tripolium</i> (Uragiku), Asteraceae	Hokkaido, Honshu (Osaka Pref.); Europe; Russia
7 <i>B. notella</i> Seksjaeva, 1996	Yomogi-Chibiga	<i>Artemisia princeps</i> (Yomogi), Asteraceae	Hokkaido, Honshu (Nagano, Mie, Nara, Osaka, Wakayama, and Hyogo Prefs.), Kyushu; Russian Far East
8 <i>B. nota</i> Seksjaeva, 1989	Iwate-Yomogi-Chibiga	<i>Artemisia princeps</i> (Yomogi), Asteraceae	Honshu (Iwate, Nagano Prefs); Russian Far East
9 <i>B. sp. 2</i> (nr. <i>varia</i> Seksjaeva, 1992)	—	Unknown	Honshu (Iwate Pref.)
10 <i>B. sinevi</i> Seksjaeva, 1988	Shinefu-Chibiga	Unknown	Hokkaido; Russian Far East
11 <i>B. altera</i> Seksjaeva, 1989	Amûru-Chibiga	Unknown	Hokkaido; Russian Far East
12* <i>B. pyrivorella</i> Kuroko, 1964	Nashi-Chibiga	<i>Pyrus pyrifolia</i> , <i>Malus pumila</i> var. <i>domestica</i> , <i>M. sieboldii</i> , <i>Prunus</i> × <i>yedoensis</i> (Nashi, Ringo, Zumi, Sakura), Rosaceae	Hokkaido, Honshu, Shikoku, Kyushu. Korean Peninsula, Russian Far East
13* <i>B. citima</i> Seksjaeva, 1989	Kurotsubara-Chibiga	<i>Rhamnus davurica</i> Pall. var. <i>nipponica</i> (Kurotsubara), <i>R. japonica</i> var. <i>decipiens</i> (Kuroumemodoki) (new record), Rhamnaceae	Hokkaido (new record); Honshu: Iwate, Nagano
14 <i>B. armata</i> Seksjaeva, 1989	Shinanoki-Chibiga	<i>Tilia japonica</i> (Shinanoki), Tiliaceae	Hokkaido; Russian Far East
15 <i>B. univoca</i> Meyrick, 1918	Noasagao-Chibiga	<i>Ipomoea congesta</i> , <i>I. batatas</i> (Noasagao, Satsumaimo), Convolvulaceae	Kyushu (Kagoshima Pref.), Ryukyu (Okinawa Is., Ishigaki Is., Okinawa Pref.); China: Taiwan (Taibai); India.
16* <i>B. demaryella</i> (Duponchel, 1840)	Kuri-Chibiga	<i>Castanea crenata</i> (Kuri), Fagaceae, <i>Betula platyphylla</i> var. <i>japonica</i> (Shirakanba), Betulaceae	Hokkaido; Honshu (Tochigi, Nagano, Aichi, Nara and Osaka Prefs.); West Europe; Russia
17 <i>B. serratella</i> sp. nov.	Keyaki-Chibiga	<i>Zelkova serrata</i> (Keyaki), Ulmaceae	Honshu (Tokyo, Nagano, Aichi, Mie, Nara and Osaka Prefs.)
18 <i>B. kogii</i> sp. nov.	Kogi-Chibiga	Unknown	Hokkaido
19 <i>B. thoracella</i> (Thunberg, 1794)	Yamabuki-Tora-Chibiga	<i>Tilia japonica</i> (Shinanoki), Tiliaceae	Hokkaido, Honshu (Nara Pref.); Europe
20 <i>B. muraseae</i> sp. nov.	Hannoki-Chibiga	<i>Alnus japonica</i> (Hannoki), Betulaceae	Hokkaido, Honshu (Nara, Wakayama, Osaka, Hyogo Prefs.)
21 <i>B. cidarella</i> (Zeller, 1839)	Shirahoshi-Chibiga	Unknown in Japan	Honshu (Nagano, Gifu Prefs.); Kazakhstan, Europe
22 <i>B. tsurubamella</i> sp. nov.	Kunugi-Chibiga	<i>Quercus acutissima</i> (Kunugi), Fagaceae	Honshu (Nara and Osaka Prefs.)
23* <i>B. comparabile</i> Seksjaeva, 1989	Konara-Chibiga	<i>Quercus crispula</i> , <i>Q. dentata</i> (Mizunara, Kashiwa) and Presumably, <i>Q. serrata</i> (Konara), Fagaceae	Hokkaido, Honshu (Tochigi, Nagano, Osaka and Presumably, <i>Q. serrata</i> Prefs.); Europe; Russian Far East

*Recorded species: Kuroko (1982); Oku (2003); Arita *et al.* (2009); Kobayashi *et al.* (2009)

Table 2. Grouping of Japanese species based on Braun (1963) and Baryshnikova (2008).

Braun, 1963		Baryshnikova, 2008	
Section (8)	species groups (16)	Japanese species	
I	<i>magnella</i>	1	<i>firmianella</i> Kuroko
II	<i>gnaphaliella</i>		<i>hamaboella</i> Kobayashi, Hirowatari & Kuroko
III	<i>lavaterella</i>	2	<i>splendida</i> Seksjaeva
IV	<i>albella</i>		<i>laciniatella</i> Benander
V	<i>ceanothiella</i>		sp. 1 (nr. <i>bicinica</i> Seksjaeva)
VI	<i>albedinella</i>		<i>maritima</i> Stainton
VII	<i>ilecella</i>		<i>notella</i> Seksjaeva
VIII	<i>bechsteinella</i>		<i>nota</i> Seksjaeva
	<i>frangutella</i>		sp. 2 (nr. <i>varia</i> Seksjaeva)
	<i>armata</i>	3	<i>sinevi</i> Seksjaeva
	<i>basifuscella</i>		<i>altera</i> Seksjaeva
	<i>demaryella</i>	4	<i>pyrivorella</i> Kuroko
	<i>cidarella</i>	5	<i>citima</i> Seksjaeva
	<i>ulmella</i>	6	<i>armata</i> Seksjaeva
	<i>endospiralis</i>	7	<i>univoca</i> Meyrick
	<i>formosa</i>	8	<i>demaryella</i> (Duponchel)
			<i>serratella</i> sp. nov.
			<i>kogii</i> sp. nov.
		9	<i>thoracella</i> (Thunberg)
			<i>muraseae</i> sp. nov.
			<i>cidarella</i> (Zeller)
		10	<i>tsurubamella</i> sp. nov.
			<i>comparabile</i> Seksjaeva

itive and diverged independently from leaf mining species.

The female genital characters

Braun (1963) reported that the inception of the ductus seminalis is adjacent to the ostium, or more generally at the junction of the sclerotized section with the more anterior membranous section. Only one species among the 99 North American species, *B. platyphylla* Braun, 1963, was reported with a posterior lobe of the corpus bursae receiving the ductus seminalis (Braun, 1963). Seksjaeva (1996) and Baryshnikova (2003) reported in relation to some species that the inception of the ductus seminalis is immediately below the ostium busae, or at the border of sclerotized and membranous parts of the ductus bursae. However, Kobayashi *et al.* (2009) pointed out that the female genitalia of *B. hamaboella* have the unique character that the inception of the ductus seminalis extends to the middle of the corpus bursae, and that further examination was required to confirm this character in more species.

In this study, the female adults of 18 Japanese species (excluding *B. laciniatella*, *B. nota*, and *B. kogii*) were examined. As a result, we confirmed that the ductus seminalis is attached to the middle of the corpus bursae in all examined species. Baryshnikova (2005) reported that the ductus seminalis of *B. sinevi* inserts immediately below the ostium. However, the “ductus seminalis” reported by her seems to be a duct of the spermatheca and lagena receptaculi. As for the female genitalia of other species (e.g. *B. splendida*, *B. altera*, and *B. arma-*

ta), she did not describe or report the ductus seminalis. On the other hand, Rubinoff & Osborne (1997) reported that in the North American species, *B. tetradymiae* and *B. dominatrix*, the ductus seminalis arises on the corpus bursae near the base of the ductus bursae. Thus, inception of the ductus seminalis seems to be misidentified in Braun (1963) and Baryshnikova (2005). In conclusion, we consider that the extension of the inception of the ductus seminalis to the middle of the corpus bursae is one of the important autapomorphies in *Bucculatrix*.

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摘 要

日本産チビガ科の分類学的再検討 (小林茂樹・広渡俊哉・黒子 浩)

チビガ科 Bucculatricidae は、幼虫が若齢期に葉にもぐる潜葉性の小蛾類である。成虫は開張 6–8 mm で、世界ではおよそ 250 種が知られる。中齢期において幼虫は潜孔を脱出し、老熟すると本科に特徴的な縦の隆条をもった舟底形のマユを葉や枝上につくり蛹化する。日本では、アオギリチビガ *Bucculatrix firmianella* Kuroko, 1982, ナシチビガ *B. pyrivorella* Kuroko, 1964, クロツバラチビガ *B. citima* Seksjaeva, 1989 の 3 種が知られており、最近筆者らによってハマボウチビガ *B. hamaboella* Kobayashi, Hirowatari & Kuroko, 2009, ならびにコナラチビガ *Bucculatrix comporabile* Seksjaeva 1989 とクリチビガ *B. demaryella* (Duponchel, 1840) が追加された (有田他, 2009)。しかし、本科にはヨモギ属を寄主とするヨモギチビガ *Bucculatrix* sp. など、多くの未同定種の報告があり、種の分類・生活史の解明度が低く、種レベルの研究が不十分であった。そこで本研究は、日本産の本科の新種を含む未解明種の形態・生活史を明らかにすることに努め、既知種を含めた本科の分類学的再検討を行った。

野外調査とともに大阪府立大学や小木広行氏 (札幌市), 平野長男氏 (松本市), 村瀬ますみ氏 (和歌山市) などの所蔵標本を用い、日本各地の成虫を調査した。奥 (2003) が同定を保留した 4 種についても、交尾器の形態を確認した。

その結果、4 新種、11 新記録種、2 学名未決定種を加えた計 23 種を確認した。確認された 23 種を、交尾器の特徴から 10 種群に分類し、16 種の幼虫期の習性をまとめ、3 タイプに分類した。

幼虫習性は、11 種で多くのチビガ科の種でみられる型 (1. 中齢以降は葉の表面にでて葉を摂食する。2. 脱皮マユは 2 回作る) が見られ、茎潜り、ヨモギにつく 3 種に見られた脱皮マユを一度しか作らない型は、Baryshnikova (2008) の系統の初期に分化したと考えられるグループに属した。

ヤマブキトラチビガとシナノキチビガはシナノキの葉の表と裏側をそれぞれ利用していたが、形態は大きく異なっており、それぞれ、ブナ科とバラ科に潜孔するグループに形態的に近縁と考えられた。また、メス交尾器の受精管が交尾のうの中央に開口することが本科の共有派生形質であることを示唆し、さらに調査した日本産 18 種でこの形質状態を確認できた。

1. *Bucculatrix firmianella* Kuroko, 1982 アオギリチビガ (Plates 1 (1), 2 (1–11). Figs 3A–C, 10A)

開張 6–8 mm. 前翅は白色に不明瞭な暗褐色条が走り、前翅 2/3 から翅頂に黒鱗が散在する。雄交尾器のバルバ、ソキウスは丸く、挿入器は細長い。幼虫は 6–10 月にアオギリの葉にらせん状の潜孔を作る。住宅の庭木や大学キャンパスなどで発生がみられた。分布: 本州, 四国, 九州。寄主植物: アオギリ (アオギリ科)。

2. *Bucculatrix hamaboella* Kobayashi, Hirowatari & Kuroko, 2009 ハマボウチビガ (Plates 1 (2), 2 (12–17). Figs 1D, 3D–F, 10B)

開張 5.5–8 mm. 前翅は白色から暗褐色で黒鱗が全体に散在する。雄交尾器のバルバ、ソキウスは長く、バルバの先端に 1 対の突起がある。幼虫は初夏から 11 月初旬までみられ、若齢幼虫はハマボウの葉に細長く線状に潜り、その後茎内部に潜る。三重県では、蕾内部に潜孔している幼虫や種子の摂食が観察されている (中野・間野, 未発表)。分布: 本州 (三重, 和歌山) 寄主植物: ハマボウ (アオイ科)。

3. *Bucculatrix splendida* Seksjaeva, 1992 ハイイロチビガ (新記録種) (Plates 1 (3), 2 (18–20). Figs 1C, 3G–I, 9E, 10C)

開張 8 mm 内外。前翅及び冠毛は黒色で、容易に他種と区別できる。本種は、奥 (2003) によって *Bucculatrix* sp. 4 として記録された。幼虫は、夏にみられヨモギの葉の表側表皮を残して薄く剥ぎ、点々と食痕を残す。分布: 北海道, 本州 (岩手, 長野); ロシア極東。寄主植物: ヨモギ (キク科)。

4. *Bucculatrix laciniatella* Benander, 1931 アズサガワチビガ (新称, 新記録種) (Plates 1 (4), Figs 3J-L)

開張 9 mm. 前翅は白色で, 前縁から後方に明るい茶色の斜列条が走る. 雄交尾器の挿入器は先端が鉤爪状に反り, バルバの先端には細かい棘状の突起がある. 平野長男氏採集の長野県梓川産の 1♂ にもとづいて記録した. ヨーロッパでは, *Artemisia laciniata* (キク科) を寄主とすることが知られる. 分布: 本州 (長野); ヨーロッパ. 寄主植物: 日本では未確認.

5. *Bucculatrix* sp. 1 (nr. *bicinica* Seksjaeva, 1992) (Fig. 9D)

本種は, 奥 (2003) によって *Bucculatrix* sp. 3 として記録された. 雄交尾器は, 挿入器の先が大きく反り返り, 把握器は長細くなる. 沿海州産の *B. bicinica* Seksjaeva, 1992 に雄交尾器は似るが, 同定を保留した. 分布: 本州 (岩手). 寄主植物: 不明.

6. *Bucculatrix maritima* Stainton, 1851 ウラギクチビガ (新称, 新記録種) (Plates 1(5), 2(21, 22). Figs 9A, 10D)

開張 7.5 mm. 前翅は濃茶色に白色が混じり, 基部に明瞭な白斜条が走る. 雄交尾器の把握器は先端が深く切れ込み, 雌交尾器の交尾口は, おわん型になる. 小木広行氏採集の北海道鹿追産の 1♂ と山崎一夫氏採集の大阪府大阪市産の 1♀ にもとづいて記録した. 山崎 (私信) によると潜孔とマユを大阪市北港処分地で観察している. 同様に淀川河口付近のウラギクでも潜孔痕が観察できた. ヨーロッパでは, ウラギク *Aster tripolium*, *Artemisia maritima* (キク科) を寄主とすることが知られる. 分布: 北海道, 本州 (大阪); ヨーロッパ, ロシア. 寄主植物: ウラギク (キク科).

7. *Bucculatrix notella* Seksjaeva, 1996 ヨモギチビガ (新称, 新記録種) (Plate 1 (6), 2 (23-28). Figs 1C, 4A-D, 10E)

開張 6-7 mm. 前翅は乳白色で, 茶から暗褐色の斜条が前縁 1/2 および 2/3 に走るが, 斑紋の変異が大きい. 雄交尾器は, テグメンの先端が発達し, 雌交尾器の交尾口はカップ状になる. 幼虫は, 春から秋にかけてみられ, 近畿地方では冬にも若齢幼虫がみられた. 後齢幼虫はヨモギの葉に小孔を開け, そこから組織を摂食する. 北海道では, ハイイロチビガと混棲しているのが観察された. 分布: 北海道, 本州 (長野, 三重, 奈良, 大阪, 和歌山, 兵庫), 九州; ロシア極東. 寄主植物: ヨモギ (キク科).

8. *Bucculatrix nota* Seksjaeva, 1989 イワテヨモギチビガ (改称, 新記録種) (Plate 1 (7). Figs 1C, 4E-G, 9B)

開張 8 mm. 前翅は乳白色に褐色の斜条が走る. 本種は, 奥 (2003) によってヨモギチビガ *Bucculatrix* sp. 1 として生態情報とともに記録されたが, ヨモギを寄主とするチビガとしては全国的に前種の方が普通に見られるので本種をイワテヨモギチビガとした. 形態, 生態ともに前種に似るが, 雄交尾器のソキウスが長く発達し, 挿入器の先端は大きくフック状に反る. 分布: 本州 (岩手, 長野); ロシア極東. 寄主植物: ヨモギ, オオヨモギ (キク科).

9. *Bucculatrix* sp. 2 (nr. *varia* Seksjaeva, 1992) (Fig. 9C)

本種は, 奥 (2003) によって *Bucculatrix* sp. 2 として記録された. 雄交尾器は, ソキウスの側面が広がり, 把握器は先が指状になる. 沿海州産の *B. varia* Seksjaeva, 1992 に雄交尾器は似るが, 同定を保留した. 分布: 本州 (岩手). 寄主植物: 不明.

10. *Bucculatrix sinevi* Seksjaeva, 1988 シネフチビガ (新称, 新記録種) (Plate 1 (8). Figs 4H-I, 10F)

開張 7.0-8.0 mm. 前翅は乳白色で, 茶鱗が散在する. 雌雄交尾器は, 特徴的で雄交尾器のソキウスは小さく, バルバは幅広く先端が尖る. 雌交尾器の交尾口の両側には牛角状の突起が伸びる. 分布: 北海道; ロシア極東. 寄主植物: 不明.

11. *Bucculatrix altera* Seksjaeva, 1989 アムールチビガ (新称, 新記録種) (Plate 1 (9). Figs 5A-E, 11A)

開張 7.0-8.2 mm. 前翅は白色で茶~暗褐鱗が散在する. 雄交尾器は, 挿入器内に多数の鉤爪状突起がある. 雌交尾器は, 前種と同様に角状突起を有しアントゥルムは幅広の筒状になる. 分布: 北海道; ロシア極東. 寄主植物: 不明.

12. *Bucculatrix pyrivorella* Kuroko, 1964 ナシチビガ (Plate 1 (10), 2 (29-32), 3 (1-7). Figs 1A, 2, 5E-G, 11B)

開張 7.0-8.0 mm. 前翅は白色で, 不明瞭な明るい茶の斜条が走る. 雄交尾器のソキウスとバルバは弱く硬化し, エデアグスは長い. 幼虫は, 奈良では5月から9月まで発生し, 街路樹や庭木のサクラでよくみられる. かつてはナシ園の害虫として問題となった. 分布: 北海道, 本州, 四国, 九州; 韓国, ロシア極東. 寄主植物: ナシ, リンゴ, サクラ類, ズミ (バラ科).

13. *Bucculatrix citima* Seksjaeva, 1989 クロツバラチビガ (Plate 1 (11), 3 (8-11). Figs 5H-J, 11C)

開張 6.0-7.0 mm. 前翅は乳白色で, 前縁 1/3 と 2/3 から後縁に濃茶の斜列条が走る. 雄交尾器は, ソキウスを欠きバルバ先端は櫛歯状になる. 本種は, 奥 (2003) がクロツバラから採集した幼虫を飼育・羽化させ, 日本から記録した. 本研究では, クロウメモドキを新たに寄主に加え, 幼虫の発育過程を記載した. また, 雌交尾器を初めて図示した. 分布: 北海道, 本州 (岩手, 長野); ロシア極東. 寄主植物: クロツバラ, クロウメモドキ (クロウメモドキ科).

14. *Bucculatrix armata* Seksjaeva, 1989 シナノキチビガ (新称, 新記録種) (Plates 1 (12), 3 (12-21). Figs 6A-C, 11D)

開張 6.0-7.5 mm. 前翅は白色で, 不明瞭な燈褐鱗が散在する. 雄交尾器はソキウスを欠きバルバは強く硬化する. 幼虫は8月に発生し, シナノキの葉の表側を主に利用する (小木広行氏観察). 北海道では, 本種とヤマブキトラチビガが葉の表と裏側をそれぞれ利用するのが観察されている. 分布: 北海道; ロシア極東. 寄主植物: シナノキ (シナノキ科).

15. *Bucculatrix univoca* Meyrick, 1918 ノアサガオチビガ (新称, 新記録種) (Plates 1 (13), 3 (22-30). Figs 6D-H, 11E)

開張 5.0-6.5 mm. 前翅は茶色で 1/2 に黒点, 前翅 2/3 から翅頂に黒鱗が散在する. 雄交尾器は特徴的で, バルバの中ほどに突起が発達し, その先端は櫛歯状になる. 幼虫は9月にみられたが, 村瀬 (私信) によると2月初旬に採集されたことから, 年間を通して発生すると思われる. 分布: 九州 (鹿児島 [奄美]), 琉球 (沖縄 [沖縄本島, 石垣島]); 台湾, インド. 寄主植物: ノアサガオ, サツマイモ (ヒルガオ科).

16. *Bucculatrix demaryella* (Duponchel, 1840) クリチビガ (Plates 1 (14-15), 4 (1-13). Figs 7A-C, 11F)

開張 6.0-7.5 mm. 前翅は黄白色で, 茶褐鱗が散在する. 本種, クヌギ, コナラ, ケヤキ, コギチビガは斑紋が酷似し, 確実な同定は交尾器の確認が必要. 幼虫は7月初旬から10月まで発生し, クリ, シラカンバの葉に短い螺旋状の潜孔を作る. 本種はヨーロッパでは他にカエデ類, ハシバミ類を利用することが知られる. 那須御用邸 (栃木県) の調査で日本から記録された (有田他, 2009). 分布: 北海道, 本州 (栃木, 長野, 愛知, 奈良, 大阪); ヨーロッパ, ロシア. 寄主植物: クリ (ブナ科), シラカンバ (カバノキ科).

17. *Bucculatrix serratella* sp. nov. ケヤキチビガ (新種) (Plates 1 (16), 4 (14-22). Figs 7D-F, 12A)

開張 5.0-6.0 mm. 前翅は黄土色で, 茶褐鱗が散在する. 雄交尾器の挿入器とユクスタの先端は鋭く尖る. 雌交尾器の第8節腹側は硬化し, しわ状の模様がある. 本種は, 大和田ら (2006) によって皇居で採集されたマユと食痕からケヤキチビガ *Bucculatrix* sp. 1 として記録されたものである. 幼虫は, 5月から10月に発生し, ケヤキの葉に線状の潜孔を作る. 本種は, 街路樹や寺社林などでよく見られる. 分布: 本州 (東

京, 長野, 愛知, 三重, 奈良, 大阪). 寄主植物: ケヤキ (ニレ科).

18. *Bucculatrix kogii* sp. nov. コギチビガ (新種) (Plate 1 (17). Figs 7 G-I)

開張 7-8 mm. 前翅は白色で茶鱗を散布する. 雄交尾器は前種に似るが, 挿入器先端に多数の棘状突起を有し, ユクスタも小さい. ♀は未知. 分布: 北海道. 寄主植物: 不明.

19. *Bucculatrix thoracella* (Thunberg, 1794) ヤマブキトラチビガ (新称, 新記録種) (Plates 1 (18-19), 4 (23-30). Figs 1B, 7J-K, 12B)

開張 6-7.5 mm. 前翅は山吹から燈褐色で 1/2 に黒色帯, 同様に中央から翅頂に黒色中線が走る. 北海道産の個体は, 斑紋が明瞭ではない. 本州では奈良県大台ヶ原で成虫のみが得られており, 北海道では幼虫は 6-8 月に発生し, シナノキの葉の裏側を主に利用する (小木広行氏観察). 8 月の世代はマユで越冬する. ヨーロッパでは, カエデ類, クリ類, ブナ類も利用することが知られている. 分布: 北海道, 本州 (奈良 [大台ヶ原]); ヨーロッパ. 寄主植物: シナノキ (シナノキ科).

20. *Bucculatrix muraseae* sp. nov. ハンノキチビガ (新種) (Plates 1 (20), 5 (1-6). Figs 8A-B, 12C)

開張 6-8 mm. 前翅は乳白色で明るい茶の 3 斜線条が走る. 雄雌交尾器は次種に似るが雄交尾器のソキウスの形で区別できる. 幼虫は 7 月初旬から 9 月に発生し, 黄褐色のマユを作る. 分布: 北海道, 本州 (奈良, 大阪, 和歌山, 兵庫). 寄主植物: ハンノキ (カバノキ科).

21. *Bucculatrix cidarella* (Zeller, 1839) シラホシチビガ (新称, 新記録種) (Plate 1 (21). Figs 8C-D, 12D)

開張 7-8 mm. 前翅は黒色に前後縁に白紋がある. 北アメリカの *B. locuples* Meyrick に雌雄交尾器が酷似するが, 前翅の白紋の色で区別できる. ヨーロッパでは, ハンノキ属を寄主植物とする. 分布: 本州 (長野, 岐阜); ヨーロッパ. 寄主植物: 日本では未確認.

22. *Bucculatrix tsurubamella* sp. nov. クヌギチビガ (新種) (Plates 1 (22), 5 (7-12). Figs 8 E-G, 12E)

開張 6-7 mm. 前翅は茶白色で, 茶鱗が散在する. 雄交尾器は単純で, バルバは先が尖り基部が融合する. 幼虫は 8, 9 月に発生し, クヌギの葉に線状の潜孔を作る. 里山の雑木林でみられるが, 数は多くない. 分布: 本州 (奈良・大阪). 寄主植物: クヌギ (ブナ科).

23. *Bucculatrix comporabile* Seksjaeva 1989 コナラチビガ (Plates 1 (23, 24), 5 (13-21). Figs 8H-J, 12F)

開張 6-7 mm. 前翅は前種によく似る. 雄交尾器も前種に似るが, バルバは丸くなり基部は融合しない. 雌交尾器を初確認し, 前種と区別するのは困難. 幼虫は, 北海道で 7 月下旬から 10 月に発生し, コナラ属の葉に線状の潜孔を作る. 寄主植物・幼虫の生活史を明らかにし, 図示した. 那須御用邸 (栃木県) の調査で日本から記録された (有田他, 2009). 分布: 北海道, 本州 (栃木, 長野, 大阪); ロシア極東. 寄主植物: カシワ, ミズナラ, コナラ (ブナ科).

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